Vol. XVII No. 9

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AGRICULTURE, GENERAL

FACTORS AFFECTING THE DIGESTIBILITY OF FLAX-PLANT FEED IN VITRO AND IN VIVO

(Publication No. 22,461)

Olaf E. Kolari, Ph.D.
University of Minnesota, 1957

Flax-plant feed has been tentatively named "flax plant product" by the Association of American Feed Control Officials. It is that portion of the flax plant remaining after harvesting the seed and separation of the bast fibers and flax shives. It consists of the leaves, cortical tissues, flax seed bolls, and broken and immature flax seeds.

The influence of the following additions upon the digestibility of flax-plant feed fiber was tested in 323 in vitro trials: corn, molasses, urea, soybean oil meal, linseed oil meal, alfalfa meal, tankage, cobalt chloride, sodium sulfate, diethylstilbestrol, yeast, oxytetracycline and chlortetracycline.

Three lots of three sheep per lot were used in digestion trials during four experimental periods in which flax-plant feed was the principal feedstuff in eleven test rations. Timothy hay was included in one ration as a negative control. The influence of the addition of corn, molasses, soybean oil meal, linseed oil meal, urea and alfalfa meal, alone or in various combinations upon the digestibility of nutrients in flax-plant feed rations was tested.

From the results of the in vivo and in vitro trials with flax-plant feed the following conclusions are drawn:

The apparent digestibility of flax-plant feed when fed as the sole feedstuff to sheep is somewhat low. Its total digestibile nutrient content is 34.6 percent.

In the sheep digestibility trials the inclusion of corn in flax-plant feed rations exerted a favorable effect upon ration nutrient digestibility. In the artificial rumen trials the addition of low levels of corn, or of molasses, to flax-plant feed stimulated fiber digestibility. The supplementation of flax-plant feed in vitro with high levels of molasses, or of corn, depressed fiber digestibility.

The inclusion of molasses in a ration containing flax-plant feed, corn and soybean oil meal apparently provided no additional factor(s) stimulatory to ration nutrient digestibility by sheep.

The inclusion of soybean oil meal with flax-plant feed resulted in a slight increase in fiber digestibility in vivo. Under artificial rumen conditions, soybean oil meal additions to flax-plant feed significantly increased fiber digestibility.

The addition of urea to sheep rations, or to in vitro mixtures containing flax-plant feed and rumen fluid from a rumen fistulated sheep fed an alfalfa-brome hay ration, provided little if any stimulatory effect upon the rumen microbial population as measured by fiber digestibility.

The inclusion of a combination of soybean oil meal and corn with flax-plant feed resulted in digestibility values superior to those obtained with either corn or soybean oil meal alone as supplements to flax-plant feed in vivo.

Alfalfa meal additions to flax-plant feed significantly increased the apparent digestibility of nitrogen-free extract and increased slightly the apparent digestibility of the other ration nutrients in vivo. Alfalfa meal additions to flax-plant feed in vitro appeared to provide some factor(s) stimulatory to fiber digestion.

The addition of cobalt, sulfur, bonemeal and yeast to flax-plant feed in vitro had no statistically significant effect upon fiber digestibility.

Diethylstilbestrol additions to flax-plant feed in the artificial rumen significantly increased fiber digestibility. Under similar conditions, oxytetracycline and chlortetracycline significantly reduced fiber digestibility.

Average daily gains of the test wethers fed pelleted flax-plant feed rations throughout four trial periods (0.27 pounds per day) and average daily feed consumption (4.42 pounds per day) appeared satisfactory.

138 pages. $2.00. Mic 57-2964

WISCONSIN FEEDER PIG MARKETS AND PRICES

(Publication No. 22,377)

Orville Ellis Krause, Ph.D.
The University of Wisconsin, 1957

Supervisor: Assistant Professor Walter H. Ebling

Wisconsin farmers have been marketing feeder pigs, at about 40 pounds in weight and 8 weeks of age, for many years. Lately this industry has expanded greatly, particularly the sale of feeder pigs to other states. Problems have arisen with the rise of the industry, mainly involving the orderliness of marketing. Those concerned with different aspects of the industry--producers, sellers, buyers, marketing agents, and control agencies--have lacked basic data on markets and prices. The purpose of this study was to show the structure of the feeder pig industry in Wisconsin, both production and marketing, and to propose such conclusions as revealed by the study. It was necessary to derive primary estimates of the production, supply, and demand characteristics of the industry because so little basic data were yet available.

The procedure followed was to estimate the characteristics of supplies, sales from farms, marketing methods, movement within and outside the state, and prices as separate parts. Estimates were based mainly on sample indications, although more complete data were available in some cases. This was followed by a consideration of feeder pig pricing policy and the impact on the buyer as well as on the seller of such policy. Finally the concluding part reviewed the markets and prices pattern as a whole from the standpoint of orderliness, suggesting

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some improvements as well as some areas needing further study.

Results of the study show that Wisconsin farmers sell almost a fourth of their pigs as feeder pigs. This amounted to about 800,000 head in 1956, with about half moving to other states. The northeast half of the state is the feeder pig exporting area, as this area is short of corn but has excellent health conditions. The southwest half of the state shows considerable local movement but no outshipment of feeder pigs.

Feeder pig production and sale was mainly on a small scale as a very minor enterprise, as 85 percent of the producers reported selling less than 50 pigs in 1953. Marketing methods were mainly to dealers, to farmers, at pig fairs, and to a marketing association, while in 1957 a feeder pig marketing cooperative was organized.

Outshipment of feeder pigs to neighboring Corn Belt states has risen rapidly in late years, and shows a relatively flat seasonality as the eastern Corn Belt takes mainly fall pigs and the western Corn Belt takes mainly spring pigs.

Feeder pig prices estimated by months for the years 1953 through 1956 showed considerable fluctuation, proportionately greater than the slaughter hog price fluctuation. Most of the fluctuation was due to the price cycle, as the seasonality of feeder pig prices fluctuated less than 10 percent from average. Feeder pig buyers experienced very sharp fluctuation in gross profit from feeder pig feeding, in some months showing a considerable loss per head.

Some major conclusions were that the feeder pig industry will continue to expand along with the trend toward specialization, and that this expansion will be helped by greater efficiency in production, more orderly marketing, and by improving pig quality. More orderly marketing will be promoted by better quality controls, better buyer recourse procedures, market information dissemination (price and places of supply), expanded cooperative marketing and pig fair organization. Efforts should be continued to help feeder pig buyers decide what price can be paid for feeder pigs on the basis of expected costs relative to the probable four-months-later slaughter hog sales receipts.

168 pages. $2.20. Mic 57-2965

WATER SOLUBLE CHELATING AGENTS IN ORGANIC MATERIALS AND THEIR INFLUENCE ON THE PLANT AVAILABILITY OF TRACE METALS IN SOILS

(Publication No. 22,279)

Murray Henry Miller, Ph.D.
Purdue University, 1957

Major Professor: Alvin J. Ohlrogge

It was hypothesized that there are water soluble chelating agents in organic materials which are capable of making trace metals in soils more available to plants. To test this hypothesis, four phases of the problem were studied. These phases are:

1. The influence of organic materials on the solubility of trace metals in the soil.
2. The mobility of the complex or complexes in the soil.
3. The ability of plants to absorb the metal in the complexed state.
4. The nature of the complex formed between the metal and the organic material.

Water extracts of barnyard manure, alfalfa, and animal feces were found to be capable of removing zinc from the chelate complex which is formed between the metal and the soil organic matter. An extract of barnyard manure removed essentially all of the zinc from a Crosby loam and 75 percent of the zinc from a Brookston clay loam. Neither water nor a 2.0 N potassium chloride solution removed appreciable amounts of zinc from the soils. The zinc, after removal, was found to be complexed by materials in the extract. There were at least two complexing agents in a water extract of barnyard manure which were probably of plant origin, and which were partially destroyed by incubation of the organic materials previous to extraction. The apparent stability constant of the complexing agents in the extract of manure for zinc was found to be 7.8. This high stability constant, in addition to other evidence presented, indicates that the complexes are probably of a chelate nature.

The complexes formed between zinc and the complexing agents in a water extract of manure were found to be immobile in the soil under both a diffusion gradient and a mass flow of water. This indicates that the complexes were adsorbed on some fraction of the soil.

Iron and zinc complexed by the water extracts of manure and alfalfa were found to be much less available to corn and soybean plants than ionic zinc or iron as shown by uptake from solutions of the two forms of the metals.

The addition of manure or a water extract of manure decreased the uptake of labelled zinc from a Brookston clay loam by corn and soybean plants during an eight week growth period in a greenhouse experiment. The uptake of copper also appeared to be decreased. The uptake of manganese was increased slightly by the addition of manure, and was increased greatly by the addition of a water extract of manure. The effect of the extract increased with time throughout the growth period of the soybeans, but decreased slightly in the case of the corn. It was not determined whether or not the chelating agents in the extract were responsible for the increased availability of the manganese.

136 pages. $2.00. Mic 57-2966

OPTIMUM FIELD PLOT SIZE AND SHAPE FOR LIMA BEAN YIELDS

(Publication No. 22,212)

Robert Dale Seif, Ph.D.
Cornell University, 1957

This study was conducted to determine a reliable index which experimenters could use with their particular cost data to estimate optimum plot size for fresh lima bean yields. Alternative methods for determining optimum plot size by means other than yield of fresh beans were also investigated. The effect of plot shape was also studied.

In 1953, 1954, and 1955 three yield characters, including bean and green plant weights, were recorded from a total of ten uniformity trials of Fordhook 242 Lima Bean. Different plot sizes and shapes were constructed by adding together different combinations of basic units which utilized the entire block. For each block and character a between plot and within plot analysis on a per unit basis as in analysis of variance was computed for each different plot size and shape. H. Fairfield Smith's b' regression coefficient regression of the logarithm of between plot variance of average yields per basic unit (V_x) on logarithm of plot size (x) was computed for each character and each block using the between plot variances on a per unit basis as in analysis of variance. This regression coefficient (b') is the index which was used in a cost formula derived by H. Fairfield Smith to estimate optimum plot size.

The average 1954-55 fresh bean and green plant regression coefficients (b') were .6390 and .4712 respectively. This average fresh bean regression coefficient (.6390) gave estimates of optimum plot size of 34 square feet for variety trial cost data and 187 square feet for fungicide test cost data. The cost ratios of K_1:K_2 were 19:1 for the variety trial and 106:1 for the fungicide test. K_1 is the cost proportional to number of plots per treatment and K_2 is the cost proportional to increasing plot size. The average 1954-55 green plant regression coefficient (.4712) gave estimates of optimum plot size about one-half those estimates by the average 1954-55 fresh bean regression coefficient (.6390). A graph, using the average 1954-55 fresh bean and green plant regression coefficients, shows optimum plot sizes for ratios of K_1:K_2 ranging from 1:1 to 200:1.

The between plot variances of average yields per basic unit (V_x), two-tailed F tests of these variances and coefficients of variation were used to assess the effect of plot shape and all three methods gave similar results. In general, for all three characters; bean weights, green plant weights and number of marketable pods, square or nearly square plots tended to have between plot variances intermediate to those of long narrow plots of the same size but orientated at right angles to each other. Long narrow plots with their greatest length in the direction of a gradient gave plots with least between plot variance.

The average 1954-55 fresh bean regression coefficient (b') should be a good index to use in estimating optimum plot size for fresh lima bean yields under conditions similar to those for Long Island. Green plant weights appear to offer an alternative method to that of fresh bean weights for estimating optimum plot size for yield of fresh lima beans. 61 pages. $2.00. Mic 57-2967

INFLUENCE OF FERTILIZATION ON THE GROWTH AND CHEMICAL COMPOSITION OF NATIVE GRASSES IN SOUTHEASTERN NEBRASKA

(Publication No. 22,137)

Muhammad Sharif, Ph.D.
The University of Nebraska, 1957

Adviser: Dr. Leon Chesnin

A study was made of the influence of nitrogen and phosphorus fertilization on the production and chemical composition of certain warm season grasses in a native prairie in southeastern Nebraska.

Plots were established on three sites characterized as Pawnee soils. The principal vegetation of these locations included big bluestem, indiangrass, little bluestem and prairie dropseed. Nitrogen and phosphate applications were made in 1953. Nitrogen was applied again in 1954 to the designated plots. Treatments consisted of four levels of nitrogen, 0, 40, 80, and 120 pounds of nitrogen per acre, and three levels of phosphate, 0, 60, and 120 pounds of P_2O_5 per acre. These applications were made in all combinations.

The application of nitrogen or phosphate alone or in combination increased significantly the yield of the native grasses. Greater responses in yield and chemical composition of the grasses to the residual effect of phosphate fertilization were obtained during 1954 than in 1953. This may be due to the higher rainfall of the former year.

Application of nitrogen resulted in increased total nitrogen percentage of the forage mixture as well as increased nitrogen uptake by the plants. Application of phosphate in combination with nitrogen, at higher rates of the latter, resulted in increased nitrogen uptake by the grasses.

Total nitrogen content of big bluestem, indiangrass, little bluestem and prairie dropseed tended to decrease at later harvest dates. This decrease in total nitrogen content was mainly due to a decrease in the non-water soluble form of nitrogen in these grasses. Application of nitrogen alone or in combination with phosphate, resulted in an increase in the non-water soluble protein-nitrogen and amino acid-nitrogen contents of the grasses. Nitrates in these grasses were very low and not influenced by stage of growth or fertilization practice.

Application of nitrogen had little or no effect on the phosphorus content of the mixed grasses and individual grass species studied. Application of phosphate, alone or in combination with nitrogen markedly increased phosphorus content of the grass. The total amount of phosphorus taken up by the forage tended to increase with the use of nitrogen or phosphate fertilizers, and was greatly enhanced by the combined application of both materials. The phosphorus and nitrogen contents tended to decrease at later harvest dates.

The total cation content of the mixed grasses and each of its botanical constituents tended to remain constant. Total cation content of the plants was not affected by fertilization or stage of growth.

Calcium and magnesium contents of the mixed grasses and individual grass species tended to increase at later harvest dates but were not affected by fertilization. Potassium content of the grasses tended to decrease with maturity but was also not affected by fertilization. Sodium content of the plants was not influenced by stage of growth or fertilization.

In general, forage production and the uptake of nutrients by the grasses appeared to be influenced by amount of precipitation that occurred during investigation. The available moisture supply influenced the magnitude of the responses of the grasses to fertilization practices but did not greatly affect the direction of these responses.

195 pages. $2.55. Mic 57-2968

INITIAL INQUIRIES INTO THE POSSIBILITY OF FORMULA PRICING LIVE-GRADED MARKET HOGS UNDER CHANGING ECONOMIC CONDITIONS

(Publication No. 21,461)

Thomas Taylor Stout, Ph.D.
The Ohio State University, 1956

The study represents an attempt to devise a practical formula for accurately determining the value differential that is known to exist between live grades of market hogs. The need for such a formula arises because the present system of marketing hogs on averages does not take sufficiently into account the differential that exists. As a result, a major opportunity is being overlooked to improve hog marketing and hog quality, to benefit the conscientious producer and discriminating consumer, and to assist in strengthening demand for pork products.

Ohio Agricultural Experiment Station Bulletin Number 728, entitled "Market Hogs Can Be Accurately Graded," is the principal background reference for the study. It was mainly through this bulletin that a need for such a study was established. The study is primarily confined to live hog weights that range between 195 and 220 pounds, because it is within that weight range that most hogs are graded in the meat industry.

Part of the sample consisted of data regarding 70 carcasses selected from the Ohio study previously mentioned. The rest of the sample data, taken from studies conducted by the Ohio Swine Evaluation Station, an organization dealing in selected groups of hogs designated by the season of their birth, involved 160 fall, 1954, hogs; 177 spring, 1955, hogs; and 156 fall, 1955, hogs. These plus the 70 hogs previously mentioned made a total of 563. Because of the variance of sources for the sample, it was appropriate to apply the t-test for significant difference. Results proved that the sample could be treated as a homogeneous unit.

Prices were obtained from the National Provisioner because of its wide acceptance in the meat trade, and were applied to the weighed cuts of 260 carcasses. Value differentials for four lean and five primal cuts per one hundred pounds of chilled carcass were extracted. Regression and correlation analysis adequately established the high degree of consistency of these differentials through changing economic conditions reflected in price changes. Much better coefficients of determination were obtained when bellies were omitted, although this carried no implication that more accurate formulas would be developed by their omission. Actual practice with formulas showed more accurate results by including belly. All formula alternatives were based on a per cent of total carcass value. The use of four lean cuts alone did not prove an adequate means of calculating differentials. The use of five primal cuts resulted in much more acceptable estimates, but the degree of accuracy remained of questionable value in terms of acceptance to the meat trade. The use of five primal cuts plus fat revealed most satisfactory results, leading to computed prices by grades that ranged between 82.35 per cent and 100 per cent correct in terms of total cutout value which was used as a standard.

It was necessary to develop numerous tables of constants by grades for use in the formula. All these tables, which should prove useful for future research, were based upon the total sample of 563 hogs. Some constants developed were: dressing percentage; per cent of chilled carcass weight in four lean cuts, five primal cuts, and five primal cuts plus fat; per cent of total carcass value for each of the above specifications by months; percentage breakdown of four lean cuts, five primal cuts, and five primal cuts plus fat; percentage breakdown of hams, loins, picnics, butts, shoulders, and bellies into the various wholesale price-weight groups that would be represented in 195- to 220-pound live market hogs.

197 pages. $2.60. Mic 57-2969

SEASONAL RETURNS FROM MARKETING EGGS IN CENTRAL NEW YORK, 1955-1956

(Publication No. 22,215)

Jonathan Starbuck Tobey, Ph.D.
Cornell University, 1957

The study dealt with the seasonal costs and returns of raising sexed White Leghorn pullets and the relative profitableness of marketing eggs during different seasons of the year.

To provide the information necessary to accomplish the purposes of this study, detailed cost records were maintained by a group of poultry farmers in Central New York. Sixty-seven rearing records were obtained from September, 1954 through August, 1955. Records of costs and returns from producing eggs were also obtained from thirty-nine of the farms that cooperated in the rearing study. The laying records were obtained from February, 1955 through September, 1956.

The average cost of raising Leghorn pullets during 1954-1955 was $1.80. The average labor needed was 11 minutes per pullet. The average feed consumed was 22 pounds per bird.

Fall pullets were the most costly to raise, $2.04 per pullet. They required more expensive buildings, feed, labor and "other" costs than chicks started during other seasons.

Spring chicks were reared for the lowest cost, $1.62. They had the lowest building and equipment costs and required the least amount of feed. Winter and Summer chicks were brooded for $1.71 and $1.73 respectively.

Spring farms had the highest profits, $0.71 per layer. Fall farms had the smallest profit per layer, $0.27, while the profit per layer for Winter farms was $0.36.

Egg production costs for all farms were 42.7 cents. Fall farms had the highest production costs, 43.9 cents per dozen. Spring farms had the lowest costs per dozen, 40.8 cents, while the Winter farms produced eggs for 43.1 cents per dozen.

Spring flocks had the highest egg production, 202 eggs per layer, and sold the highest percentage of large eggs, 66.5 per cent. Winter farms had the lowest egg production, 192 eggs per bird, and sold 63.6 per cent of their eggs as large. Fall layers produced 199 eggs per bird but sold only 57.4 per cent of their eggs as large.

Seasonal variation in egg prices has been greatly reduced in the past few years. During 1956 the variation in the New York State farm price of eggs was only 24 percentage points.

With a reduction in the seasonal variation in egg prices and the trend away from brooding one batch of replacements

per year, the decision as to when pullets should be started has become less important.

Today it is not possible to produce eggs for only the most profitable months. There are few alternative uses for the expensive buildings and equipment that are needed for today's full time commercial poultry enterprise. Buildings and equipment must be utilized to the recommended capacities at all times to reduce the costs of producing eggs and maintaining hens.

The important factors for making profits at the end of the year are the flock management factors. To produce profitably, a poultryman must have high egg production along with as high a proportion of large eggs as possible.

Feed efficiency must not be overlooked. Feed accounted for more than 55 per cent of the total costs of producing eggs. The reduction of a half-pound of feed per dozen can mean a profit or loss on each dozen eggs.

Labor is the second most important cost item in producing eggs. There is still room on many of the farms for improving labor efficiency and building arrangements.

The emphasis today should be on year round records of the entire enterprise. It is important to have a year to year picture of the changing costs of production as they reflect changing practices that develop in the poultry industry.

100 pages. $2.00. Mic 57-2970

AGRICULTURE, ANIMAL CULTURE

LAMB FEEDING STUDIES WITH HORMONES

(Publication No. 22,196)

Robert Judson Davey, Ph.D.
Cornell University, 1957

Three lamb feeding experiments were conducted using a total of four hundred thirty two western feeder lambs. A factorial experimental design was used in which lots of 12 lambs were fed various combinations of concentrates and hormones. The concentrates fed in the first two trials were corn, cooked cull red-kidney beans, and a combination of one-third corn and two-thirds cooked beans. In the third trial the combination treatment was replaced by one containing raw kidney beans. The hormones used in the first trial were: (1) subcutaneous injection of 100 mg. of progesterone and 10 mg. of estradiol and (2) 5 mg. of stilbestrol fed per lamb daily for the first 56 days reduced to 24 mg. for the last 35 days; in the second trial (1) stilbestrol fed at 5 mg. per lamb daily for the first 54 days reduced to 1 mg. for the last 49 days, (2) 5 mg. of stilbestrol for the first period and none in the second, and (3) benzestrol fed at levels of 5 and 1 mg. per lamb daily; and in the third trial (1) stilbestrol fed at 5 and 2.5 mg. per lamb daily for 42 and 63 days, respectively, (2) benzestrol fed in the same manner, (3) stilbestrol fed as in group (1) plus 0.75 gm. of thyroprotein per lamb daily for the entire 105 days, and (4) stilbestrol as in (1) plus 0.50 gm. of thiouracil per lamb daily for the last 63 days of the feeding period. A control group was fed in each trial.

Statistical analysis of the data for gains showed significant differences between those for controls (0.33 lb. per day) and the two hormone-treated groups (0.38 lb. for progesterone-estradiol and 0.41 lb. for stilbestrol) in the first trial. Significant differences were not found for gains in the second trial. The gains of the controls in the third trial were significantly lower (0.25 lb. per day) than those for stilbestrol (0.30 lb.) and stilbestrol plus thyroprotein-fed lambs (0.31 lb.).

Significant differences in gain in the third trial were also found among concentrate groups, the average gains being 0.20, 0.30, and 0.35 lb. per day for raw bean, corn and cooked bean-fed lambs, respectively; and between some initial weight groups, lighter lambs at the beginning of the experiment failing to gain as fast as heavier ones. The interaction of initial weight and concentrate groups was also significant, lighter lambs on the raw bean concentrate making the poorest gains.

Sex had no significant effect on gains in any of the trials.

Feed efficiency was improved in all trials in hormone-treated groups, stilbestrol having the most pronounced effect.

Live and carcass grades for stilbestrol-fed lambs were significantly lower than those from untreated lambs in the first trial. Differences in other years followed the same trend except that benzestrol-fed lambs graded as high as the controls.

Chemical analyses of carcass samples showed that meat from estrogen-treated lambs had larger amounts of water, protein and ash and smaller amounts of fat than did meat from untreated lambs. These differences were statistically significant in the second trial. Assay of the tissues for estrogenic residues showed significant amounts of estrogenic activity in fat from stilbestrol-fed lambs the first year and in the combined fat and lean from lambs fed stilbestrol continuously or benzestrol in the second year.

Side effects observed were udder development in hormone-treated wethers and ewes and urinary calculi in a few wethers implanted with progesterone-estradiol (trial 1) and fed stilbestrol or stilbestrol plus thyroprotein (trial 3).

On the basis of the data collected and observations made it was concluded that the feeding of stilbestrol or benzestrol to feeder lambs was a practical method of increasing rate and efficiency of gain, with however, some reduction in carcass value. A level of 5 mg. per lamb daily reduced to 2.5 mg. as the feeding period progressed gave the most satisfactory response. The finding of estrogenic activity in meat from treated lambs indicated that withdrawal of the hormones from the diet one week prior to slaughter did not allow sufficient time for the disappearance of estrogens from the tissues.

94 pages. $2.00. Mic 57-2971

STUDIES CONCERNING FROZEN BOVINE SPERMATOZOA

(Publication No. 22,448)

Wallace Elmer Erickson, Ph.D.
University of Minnesota, 1957

A series of experiments was conducted to determine the effect of five factors concerned with the low temperature

preservation of bovine spermatozoa. These factors were as follows: the effect of yolk-citrate, milk, yolk-glucose-glycine and skim milk; glass ampules and plastic vials; liquid and dry storage; three spermatozoan concentrations; and the effect of storage.

The split-ejaculate technique was utilized for each experiment. In instances where a second or a second and third ejaculate were necessary to provide sufficient semen, the ejaculates were pooled and thoroughly mixed. They were divided accordingly for each of the treatments.

Seven cooperative artificial breeding organizations participated in the experiments. For the experiments, a total of 7,955 first service cows were inseminated with frozen semen from 45 bulls. Field technicians of the respective artificial breeding organizations conducted the inseminations. An IBM method was employed for the reporting of the inseminations and summarizing the data for the determination of the fertility results.

There was no difference in fertility results when either yolk-citrate, milk or skim milk were used as the extender materials for frozen bovine spermatozoa. Variation among bulls was noted as to which of the extender materials (yolk-citrate, milk and skim milk) was the most suitable. The fertility rate obtained with frozen semen extended with skim milk was satisfactorily maintained even though the percent progressively motile spermatozoa declined to a greater extent than for yolk-citrate, milk or yolk-glucose-glycine extender. Yolk-glucose-glycine was not a suitable extender for frozen semen, based on fertility, even though the percent of progressively motile spermatozoa was satisfactory.

The difference in nonreturn rate between semen frozen and stored in glass ampules, and with semen frozen and stored in plastic vials was highly significant in favor of glass ampules. The difference in nonreturn rate between dry storage and liquid storage was not significant. The highest nonreturn rate was obtained with glass ampules-liquid storage for 6 out of 12 bulls involved in this trial. Even though the difference between glass ampule-liquid storage and glass ampules-dry storage was not significant, the trend would support the hypothesis that liquid storage would have merit.

Bovine semen to be frozen should be extended to at least 20 million live spermatozoa per ml. (per insemination) of extended semen and preferably 30 million live spermatozoa per ml. (per insemination) in order to obtain optimal nonreturn rates.

Frozen semen from most bulls can be stored for at least six months at -79°C. with no apparent decrease in nonreturn rate. A decrease can be expected when the frozen semen is stored beyond six months at -79°C.

A definite correlation generally existed between percent progressively motile spermatozoa and the percent nonreturns. This was also evident between length of storage and percent progressively motile spermatozoa. Generally, a correlation did not exist between length of storage and percent nonreturn rate. The correlation coefficients that were of significance were not of the magnitude where they could be used to predict accurately the value of one factor on the basis of the value of the other factor correlated. They do, however, indicate a definite relationship of the factors correlated.

164 pages. $2.15. Mic 57-2972

REQUIREMENT OF PROTEIN AND CERTAIN AMINO ACIDS FOR CHICKENS

(Publication No. 22,269)

Bernard Alphonse Krautmann, Ph.D.
Purdue University, 1957

Major Professor: C. W. Carrick

With methionine supplementation a ration with 18 percent of protein from corn and soybean meal was adequate to supply the protein needs of chicks to eight weeks of age. From four to eight weeks of age 16 percent of protein was adequate when supplemented with methionine, however, without methionine supplementation about 18 percent protein was needed.

Levels of 0.71 and 0.734 percent of sulfur-bearing amino acids in a corn-soybean diet were inadequate to six weeks of age, while 0.784 percent appeared to be adequate. From four to eight weeks of age approximately 0.68 percent of sulfur-bearing amino acids was adequate.

On a casein-gelatin diet the minimum tryptophan requirement was about 0.18 percent of the diet in the presence of adequate niacin. No growth response was obtained by the addition of tryptophan to a corn-soybean meal diet containing 0.154 percent of tryptophan, or an isolated soybean protein-gelatin diet containing 0.118 percent of tryptophan. An unidentified factor in isolated soy protein, not found in corn, appeared to have a sparing action on tryptophan.

Utilization of the D-isomer of tryptophan for tissue synthesis was about 32 to 100 percent, while, little if any D-tryptophan was converted to niacin.

An addition of 0.10 percent of DL-tryptophan to diets low in niacin approached adequacy for niacin.

No growth response was obtained by the addition of phenylalanine to diets containing 1.18 percent of phenylalanine and tyrosine.

When arginine was added to a corn-soybean meal diet containing 0.941 percent of arginine or to a corn-corn gluten-soybean meal diet containing 0.85 percent or arginine, no growth response was obtained. Inclusion of corn or soybean meal in a casein diet low in arginine resulted in a marked growth response. No growth response was obtained by the inclusion of grass juice concentrate, corn steep liquor, or corn starch. In corn the growth promoting factor appears to be more concentrated in the germ and bran than in the endosperm fraction. Soybean meal appears to be a richer source of the factor than corn germ. Intestinal microbial synthesis was probably not responsible for the growth response obtained from corn when a low arginine, casein diet was fed.

Two separate unidentified factors appeared to be involved in these studies. The evidence points to a factor in both corn and soybean meal which enhances the availability or utilization of arginine, and another factor in soybean protein, not found in corn, which enhances the availability or utilization of tryptophan.

64 pages. $2.00. Mic 57-2973

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

A STUDY OF PROTEIN AND CALCIUM REQUIREMENTS OF BABY PIGS

(Publication No. 22,474)

Elmer Al Rutledge, Ph.D.
University of Minnesota, 1957

Investigations were conducted to obtain additional information concerning the dietary protein and calcium requirements of pigs weaned at approximately three weeks of age.

Growth studies were conducted with 39 Duroc pigs weaned at three weeks of age to determine the influence of the protein content of the diet upon weight gains and efficiency of feed utilization. This experiment was followed by a series of 16 nitrogen balance trials using the same protein levels (16, 20, 24, and 28 percent) as those used in the growth studies.

The protein content of the diet had no significant effect on average daily gain. Good growth was obtained on all four levels. A definite trend was shown toward an improvement in efficiency of feed utilization with increasing protein content of the diet. The 16 percent (16.9) protein diet appeared to provide for adequate protein and essential amino acid nutrition of the pigs used in this investigation.

Results of nitrogen balance studies showed that the amount of protein in the diets fed to 3- to 9-week old pigs, had little or no effect upon the apparent digestibility of the protein in the diet.

A highly significant ($P \leq 0.01$) difference was obtained in percent of absorbed nitrogen retained by the pigs due to level of dietary protein, four protein levels (16, 20, 24, and 28 percent) being considered. A highly significant ($P \leq 0.01$) linear trend was also obtained indicating that as the percent of the protein in the diet was increased the percentage of absorbed nitrogen retained by the pigs decreased.

The mean percentage of absorbed nitrogen retained by pigs fed the 24 and 28 percent protein diets differed significantly from that obtained when pigs were fed the 16 and 20 percent protein diets. The percentages of absorbed nitrogen retained by pigs fed the 16 and 20 percent protein diets did not differ significantly and, in fact, were nearly equal in response.

From the results obtained in this study, it may be concluded that the 16 (16.9) percent protein diet as used in this investigation provided for adequate protein and essential amino acid nutrition for baby pigs 3 to 8 weeks of age.

The calcium requirement of early weaned pigs was investigated using 16 crossbred (8 Yorkshire x Duroc and 8 Yorkshire x Chester White) pigs. These pigs were fed diets containing four levels (0.4, 0.6, 0.8, and 1.0 percent) of dietary calcium during the period from 3 to 9 weeks of age.

The data obtained in these studies show that the level of dietary calcium had no consistent effect upon rate of gain or the efficiency of feed utilization by the 3- to 9-week old pigs. Physical abnormalities occurred in one pig on the low (0.4 percent) calcium diet. This condition did not appear to interfere with the pig's gain or efficiency of feed utilization.

Serum calcium and phosphorus values were not influenced by either of the four levels of calcium fed in this experiment.

A significant linear trend was obtained toward an increase in ash and calcium content of the femur bone samples as the dietary calcium was increased from 0.4 to 1.0 percent. Breaking strengths of the humeri also increased significantly with increased levels of calcium in the diet.

It may be concluded from the results of this experiment that pigs between 3 and 9 weeks of age require a minimum of 0.8 percent calcium in the diet for normal bone development. 82 pages. $2.00. Mic 57-2974

AN ANALYSIS OF THE EARLY DEVELOPMENT OF THE MINNESOTA NO. 3 INBRED LINE OF SWINE

(Publication No. 22,478)

Lavon John Sumption, Ph.D.
University of Minnesota, 1957

Major Adviser: L. E. Hanson

The Minnesota No. 3 is based on a foundation of eight lines of swine, including three outbred breeds and five inbred lines. A total of 12 basic breeds have contributed. Data were studied from the first five years of development, including 267 spring-farrowed litters and 2345 pigs; 222 litters and 1653 pigs completed performance testing.

Methods of breeding and management were described in detail because of the departure from previous practice and their bearing on effective selection. The multiple sire system of mating and the testing procedures have allowed for capitalization on natural selection. The study included:

1. Consideration of the potentialities of recombination with the number of foundation breeds and multiple sire mating taken into account.
2. Estimation of inbreeding and relationship coefficients under multiple sire mating.
3. Estimation of the percentage of contribution of parent breeds to the line, by generations.
4. An analysis of selection.

Possibilities for an extended period of recombination are treated by description and diagrams. Evidence for recombination is presented in 48 color plates. The selected "F_5" provides phenotypic evidence for a high level of genetic variation and effective future selection.

Inbreeding and relationship coefficients were estimated by an extension of Wright's method. Average inbreeding reached .14 in the "F_5". Estimated inter-se relationship for the "F_5" was .33.

Sixteen animals representing eight lines contributed to the foundation of the No. 3. This line is based on the following estimated breed composition: 14% Welsh, 31% Gloucestershire Old Spot, 12% Large White, 20% "C" Poland China, 7% Beltsville No. 2, 5% San Pierre, 6% Minnesota No. 1 and 5% Minnesota No. 2. English breeds were deliberately favored in the early selection of sires so that the No. 3 would be genetically more diverse from the Minnesota No. 1 and No. 2.

Selection has been effective in the early development of this line. The contributors were consistently higher in

performance than the selected population. Selection differentials were large in absolute terms and in standard deviation units. Average selection differentials were 1.23, 1.76, 4.24 lbs., 13.05 lbs. and .11 lbs. for number born, number weaned, 56 day weight, 140 day weight and rate of gain respectively. The expected genetic gain was positive for all traits studied although conservative heritability estimates were used. The average generation interval was .98. Although of short duration, time trends in performance (uncorrected for inbreeding) were positive and significant for 56 day and 140 day weight and rate of gain. The time trend was negative for number born and positive for number weaned; neither value was significant. There was a decided shift to the right in the frequency distribution of 56 day and 140 day weight during the five generations. There was little change in the distribution of number born and number weaned. Carcass data presented suggest some progress in selection for leanness.

Preliminary tests indicate the potential value of the No. 3 in rotational crosses with the No. 1 and No. 2.

These data suggest that a level of performance similar to the F_1 can be maintained during the slow advance of inbreeding by the multiple sire system of mating. It was concluded that the breeding methods employed could be recommended as an economical system for the development of inbred lines of swine.

A general concept of animal improvement based on "cyclic recombination" was proposed.

Although genetic improvement of economic traits is slow it was concluded that progress could be made provided: (1) the breeder begins with a high level of genetic variation, preferably by crossing breeds, (2) the rate of inbreeding is slow enough to provide for extensive recombination, (3) the population is large enough to produce and observe new gene combinations in numbers and (4) rigorous selection is practiced with definite objectives.

207 pages. $2.70. Mic 57-2975

THE EFFECTS OF VARIOUS GROWTH-STIMULATING MATERIALS ON THE DIGESTIBILITY AND METABOLIZABLE ENERGY OF GROWING AND FATTENING RATIONS FOR CATTLE

(Publication No. 22,302)

Donald Miller Thrasher, Ph.D.
Purdue University, 1957

Major Professor: T. W. Perry

Numerous reports exist in the scientific literature which show that active cell yeast, dehydrated alfalfa meal, chlortetracycline (Aureomycin), and diethylstilbestrol stimulate the growth rate of cattle under certain conditions when administered orally. Since little is known regarding their specific modes of action, the studies herein reported were undertaken to determine the influence of these materials on ration digestibility and metabolizable energy.

One pair of identical twin Shorthorn heifer calves was used throughout the series of digestion and energy trials. Nitrogen balance data were also taken during these experiments. The trials involving yeast, dehydrated alfalfa meal, and chlortetracycline were conducted using a basal ration of ground corn cobs and Purdue Cattle Supplement A. Corn was added to this combination to produce a fattening-type basal ration in the tests involving diethylstilbestrol.

No adjustment period was employed in the trials where chlortetracycline alone was fed. Otherwise, at least ten days were allowed for the adjustment of the animals to the rations. Ten-day collection periods were used in the digestion trials with yeast, alfalfa meal, and diethylstilbestrol. The digestion trials with chlortetracycline alone and in combination with diethylstilbestrol involved collection periods of fifteen and seven days, respectively. Seven-day collection periods were used in all the energy studies.

The calculation of digestion coefficients and metabolizable energy was done according to conventional methods, using the results of the analyses of the feeds and excreta. A bomb calorimeter was used in the energy studies to determine the energy values of all samples.

The levels at which the above-mentioned materials were tested and the results of all the experiments are given below.

Digestion Trial I. The addition of 7.95 gms. of active dry yeast per day to the basal ration had no significant effect on the digestibility of dry matter, crude protein, crude fiber, ether extract, or N.F.E. (nitrogen-free extract). The loss of nitrogen via the urine was not affected, but nitrogen retention was improved.

Digestion Trial II. The feeding of 75 mg. of chlortetracycline daily in addition to the basal ration did not cause a reduction in feed consumption. The digestibility of crude fiber and the other nutrients was not significantly affected. No change in digestibility was found between the first and last ten days of the 15-day collection period. Nitrogen retention was slightly improved.

Digestion Trial III. The replacement of the dehydrated alfalfa meal in Supplement A with wheat bran had no significant effect on the digestibility of nutrients in the basal ration. No appreciable change in nitrogen retention was noted.

Digestion Trial IV. The feeding of 10 mg. of diethylstilbestrol daily in addition to the fattening ration had no appreciable influence on the digestibility of any of the ration nutrients. Nitrogen retention was increased approximately seven percent.

Digestion Trial V. Diethylstilbestrol and chlortetracycline fed in combination (10 and 75 mg. per day, respectively) markedly reduced the digestibility of all nutrients in the fattening ration. These results are questionable, because the daily fecal weights of the treated calf were much higher than normal. Urinary nitrogen losses were six percent less for the treated calf.

Energy Trial I. Both calves received the basal ration in this experiment. The two calves differed by only 1.2 and 1.3 percentage points in the percent metabolizable and digestible energy, respectively. On the average, this ration contained 2,175 kcal. of metabolizable energy per kilogram of dry matter. In terms of digestible energy, the ration contained 2,660 kcal. per kilogram of dry matter.

Energy Trial II. The feeding of 75 mg. of chlortetracycline

daily in addition to the basal ration did not significantly reduce the metabolizable or digestible energy values either during the first or the third week of chlortetracycline feeding. During the first week the metabolizable energy values for the control and treated calves were 47.7 and 46.0 percent, respectively, a difference of 1.7 percent. Feed consumption was reduced for five days during the first week, but the appetite had returned to normal by the end of this week. Nitrogen retention was not significantly influenced.

Energy Trial III. The addition of diethylstilbestrol at the rate of 10 mg. per day to the fattening ration had very little effect on the metabolizable or digestible energy values. The metabolizable energy values for the control and treated calves were 52.7 and 53.7 percent, respectively. The feeding of this substance did not increase nitrogen retention or lower the urinary nitrogen losses during this experiment. 117 pages. $2.00. Mic 57-2976

AGRICULTURE, FORESTRY AND WILDLIFE

ECOLOGICAL EFFECTS OF DRAWDOWN OPERATIONS FOR THE PURPOSE OF IMPROVING WATERFOWL HABITAT

(Publication No. 22,456)

Stanley Warren Harris, Ph.D.
University of Minnesota, 1957

Adviser: William H. Marshall

Data are presented on the vegetation changes and wildlife use associated with a drawdown program at Mud Lake National Wildlife Refuge.

The development of five general types of marsh vegetation on bare mud flats during the first year of drawdown was influenced by seed availability, soil type and moisture conditions, year, season, and duration of drawdown, and stranded algal debris.

During the second year of drawdown most areas developed greater amounts of upland and shoreline weeds and fewer emergents. Stands originally exposed before August lost emergent cover during the second year, while on stands exposed during and after August the reverse was true. Specific changes were influenced by density and composition of the vegetation, soil types, and moisture conditions.

During longer drawdowns the soil dried thoroughly, and over a five-year period vegetation progressed to nearly solid stands of willow.

Upon reflooding, mud flat and shoreline annuals were eliminated and marshes composed of cattails, soft-stem bulrush, sedges, creeping spikerush, willows, and aquatic annuals developed. Specific development was determined by the nature of the residual vegetation and the depth of the restored water.

Spike-rush and soft-stem bulrush were destroyed by flooding with over 15 inches for three years and common cattail and sedges were gone in four years. "Hybrid" cattail thrived in 24 inches through three years. Two-year-old willows died in two to four years in all depths, but willows on four- and five-year drawdown areas were killed only where flooded with 24 inches for three to four years.

Depending on water depths and cover types, one- or two-year drawdowns at five- to ten-year intervals are required to maintain emergent marshes at Mud Lake Refuge.

Sago made outstanding growth in the first year of reflooding.

After reflooding little net effect was apparent on pre-drawdown cattail beds by drawdowns of two years.

Drawdown-created shallows and mud flats were intensively used by feeding and loafing river ducks in summer and fall. Some open water areas were heavily utilized by broods in contrast to light utilization of dense drawdown-created marshes.

High densities of nesting coots occurred in most drawdown marshes where areas of light and moderate density were apparently preferred over very dense areas.

Nearly solid stands of willow were hardly used by waterfowl.

It appeared possible that an outbreak of duck sickness and the closure of pool shorelines by upland weeds and willows were detrimental effects of the drawdown program on waterfowl.

The desirability of a drawdown is determined by four major considerations: 1) the management objective for the marsh; 2) the habitat requirements of the desired wildlife species; 3) which of these habitat requirements are lacking; and 4) whether or not the drawdown can be expected to create conditions that will provide the missing requirements.

The study indicated that three general principles of emergent habitat management are: a variety of habitat types is needed; this variety needs interspersion; and the vegetation of the types created needs optimum density.

Until present limited knowledge of the consequences of drawdowns is enlarged, the technique should be used only for relatively specific purposes with proper control and study rather than on a widespread and indiscriminate basis.

Data obtained on germination and seedling establishment of soft-stem bulrush and the significance of an observed occurrence of extensive "hybrid cattail swarms" are discussed in an appendix.

209 pages. $2.75. Mic 57-2977

PHYSICO-CHEMICAL CONDITIONS OF PODZOLIZED SOILS HINDERING THE GROWTH OF EXACTING HARDWOODS

(Publication No. 22,374)

Theodor Keller, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor S. A. Wilde

During the reforestation program, launched in Wisconsin a quarter of a century ago, attention has been given largely to coarse textured soils of fluvio-glacial origin. It was believed that natural reproduction of hardwood species would provide a valuable crop for fine textured

soils of moraines and lacustrine deposits. The fact has often been overlooked that an enormous portion of fine textured soils does not possess sufficient supply of moisture and nutrients or adequate aeration to bring to maturity the volunteer stands of exacting deciduous species which invaded cut-over and burned-over areas. The aim of this study was to formulate in concrete terms the soil conditions which assure a successful production of hardwood timber and thus justify the expenditure on improvement cuttings of second growth stands of hard maple (Acer saccharum), basswood (Tilia americana), American elm (Ulmus americana), and white ash (Fraxinus americana).

The study was initiated in the Hardwood Management Unit and the Gagen Experimental Forest of the Consolidated Water Power and Paper Company, Oneida county, and gradually extended throughout eleven counties of northern Wisconsin. In preliminary stages the soils and stands of selected tracts were subjected to detailed survey and mensuration analysis. The information thus gained permitted the subdivision of hardwood stands into three soil-stand types, characterized by average site indices of 70, 62, and 54 respectively. Particular attention was given to the stands of the two extreme site qualities.

The study of physical properties of soils included texture, structure, bulk density, air permeability, and the depth of root penetration. The investigation of moisture and temperature was conducted on sample areas by means of fiberglas units provided with thermistors. Physical analyses established two significant critical conditions precluding the growth of hardwoods at a reasonably rapid rate: (1) insufficient water retaining capacity of soil, caused by deficiency of mineral colloids; (2) impermeability of the B horizon in strongly podzolized soils leading to an excessive content of moisture in the soil profile, inadequate aeration, and subsequent development of shallow root systems. The latter feature is largely responsible for damages of stands during periods of severe drought. As air analyses have indicated, the oxygen content of the compacted zone at times approaches a critical level of ten per cent.

The determination of available nutrients has indicated that sound development of second growth hardwood stands requires the following approximate state of soil fertility factors, considering the surface six-inch layer: minimum reaction pH 5.3; cation exchange capacity 10 meq/100 g; total nitrogen 0.2 per cent; available phosphorus (P_2O_5) 35 ppm; available potassium (K_2O) 75 ppm; exchangeable calcium 4 meq/100 g; exchangeable magnesium 0.5 meq/100 g.

Results of the quantitative floristic analysis have shown, that in spite of logging and fire the composition of the ground cover vegetation serves as indicator of site quality. This relationship becomes evident when the composition of ground cover vegetation is expressed in terms of quality indices, derived on the basis of the relative density and frequency of occurrence of species possessing indicator value. The post-fire migration had a pronounced tendency to enrich the ground cover vegetation of podzolized soils in mull plants, largely because of the fertilizing effect of ashes; the opposite trend -- enrichment of mull flora in raw humus plants was not observed.

The annual return of nutrients, as given by the total oven-dry weight of leaf fall and concentration of nutrient elements, was closely related to the site quality of forest stands. Consequently, the analysis of fresh litter in hardwood stands may serve as indicator of the supply and balance of available nutrients.

101 pages. $2.00. Mic 57-2978

STUDY OF FACTORS ASSOCIATED WITH THE DEVELOPMENT OF COLLAPSE DURING KILN DRYING OF ASPEN LUMBER

(Publication No. 22,493)

Arne Kalervo Kemp, Ph.D.
University of Minnesota, 1957

Adviser: Louis W. Rees

This study deals with the determination of conditions under which collapse occurs in kiln drying of aspen lumber and an attempt to correlate other pertinent factors associated with the defect.

Based upon observed trends in a preliminary experiment, an instrument was designed and constructed that measured small changes in board profile and transmitted these changes to recording instruments outside the drying chamber, thus permitting a more exacting study of collapse.

Surfaced green-aspen boards 1.5 by 6.0 inches by 4.0 feet were used, five replications were subjected to each drying condition of 140, 150, 160, 170 degrees F and 40, 50, 60 and 70 per cent relative humidity respectively. Moisture content and specific gravity determinations were made before and immediately after the onset of collapse. Board and kiln temperatures were taken by means of thermocouples.

Statistical analysis revealed that the effect of temperature and humidity on the time-to-collapse was significant. It was determined by the method of orthogonal polynomials that the trend of time-to-collapse with temperature is represented by a linear relationship and with relative humidity by a third-degree relationship. The specific gravity difference between wetwood and sapwood was found to be nonsignificant; between heartwood and wetwood, significant at the 1 per cent level. The sigmoid relationship between time-to-collapse and relative humidity is explained on the basis of the drying behavior of green wood. At the 1 per cent level, relative humidity appears to be more significant in controlling the time-to-collapse than temperature. Collapse in aspen appeared first in the springwood within the wetwood zone during the early stages of drying while the wood was well above the fiber saturation.

The effect of water and air volume as a possible cause of collapse was investigated by kiln drying artificially saturated aspen boards and detecting collapse with the profile instrument. Heartwood, normally nonsusceptible to the defect, collapsed. However, this was preceded by collapse in wetwood. The difference between heart and sapwood in resistance to collapse is not attributable to specific gravity since wetwood has a higher specific gravity. A concept is advanced that the air-water ratio is not as critical as formerly believed. It is suggested that a minimum moisture content, which is considerably below maximum moisture content, must be in the cells of aspen wood before collapse will develop, and any amount in excess of the level will have little additional effect.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

When saturated aspen blocks of sapwood, wetwood and heartwood were dried at approximately zero per cent relative humidity with moisture movement confined to the tangential direction, sapwood had the greatest moisture loss followed respectively by heartwood and wetwood. With practically identical moisture content and specific gravity values, between sapwood and wetwood, moisture loss from wetwood was greatly reduced indicating a possible difference in structure in wetwood.

Although the specific gravity and moisture content differences between wetwood and heartwood were significant, the difference in rate of moisture loss was not appreciable. Although differences in permeability of sapwood, wetwood, and heartwood may in part be responsible for the difference in rate of moisture loss, this study did not provide evidence which would support a direct relationship. It has been shown, however, that the zones of a board which dried most rapidly did not collapse, and that collapse occurred in the zones of the board which dried most slowly.

156 pages. $2.05. Mic 57-2979

DIAGNOSIS OF DEFICIENCIES OF AVAILABLE POTASSIUM, CALCIUM, AND MAGNESIUM IN FORESTED SOILS

(Publication No. 22,387)

Albert Lazarus Leaf, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor S. A. Wilde

Application of fertilizers on depleted forest soils is practiced on a constantly increasing scale. However, fertilizer treatments can be successful only when the deficiency of certain elements is definitely established. This research aimed to determine the critical levels of potassium, calcium, and magnesium as regards the growth of red pine (Pinus resinosa, Ait.), Scotch pine (Pinus sylvestris, L.), and Norway spruce (Picea abies, (L.) Karst.). Furthermore, this investigation strived to devise an analytical procedure which would provide information on the fractions of these three cations present in soil in the form available to coniferous trees investigated.

The initial phase of the study was concerned with the relation of the nutrient content of soils and the growth of red pine plantations in Wisconsin and Scotch pine and Norway spruce plantations in Finland. These surveys failed to reveal a significant correlation between the growth of plantations and the content of available bases as determined by extraction with neutral N ammonium acetate. In a large measure, this discrepancy was undoubtedly caused by the fact that root systems of trees are armed with mycorrhizal fungi and chelating compounds; therefore, they possess much greater capacity for utilization of nutrients from unweathered minerals and undecomposed organic remains than do roots of field crops. For this reason, more effective methods for extraction of potassium, calcium, and magnesium were investigated.

Extractions of soil samples were made with acidified ammonium acetate and ammonium nitrate, 0.4 N hydrochloric acid, alkaline 0.05 M EDTA, neutral ammonium acetate following ignition of ammonium saturated soil at 500 C., and N nitric acid with boiling. The relative value of different extraction procedures was determined on the basis of analyses of some New York and Wisconsin soils whose capacity to respond to fertilizer treatments was previously established. Furthermore, the potency of different extracting solutions was appraised by analysis of various feldspathic minerals. The extraction with neutral N ammonium acetate following ignition and with boiling N nitric acid provided results best correlated with the base requirements of trees as detected by the rate of growth and response of plantations to fertilizer treatments. From the standpoint of analytical efficiency, the extraction with boiling N nitric acid proved to possess certain advantages. In flame spectrophotometry, however, the determination of calcium and magnesium is hindered by phosphorus and aluminum, elements which must be removed prior to analysis.

Analysis of foliage from stands belonging to a wide range of site indices failed to show significant differences in the concentrations of the three cations studied. In some instances, the concentration of bases in foliage of pine plantations growing on infertile aeolian sands was about as high as that in foliage of rapidly growing plantations on soils of a high fertility level. The foliar analyses were performed on samples of the current year's needles obtained from terminal leaders.

Analyses have shown that the litter collected in screen traps has a much lower concentration of potassium than does the current year's foliage. A reverse relationship was observed in regard to the concentration of calcium. Concentration of magnesium in the litter and the foliage failed to show significant differences.

The efficiency of tree root systems in extracting nutrient elements from unweathered minerals was demonstrated by results of incubation of biotite with sloughings of red pine roots. After five months in a 30 C. humidity chamber, the biotite released 38 percent of the total potassium in exchangeable form as compared with only 8 percent released in the absence of root tissues. Similar trend was observed in regard to the effect of root tissues on microcline, syenite, and other feldspathic minerals.

121 pages. $2.00. Mic 57-2980

AGRICULTURE, PLANT CULTURE

A STUDY OF THE FRAGIPANS OF SOME SOUTHERN INDIANA SOILS

(Publication No. 22,245)

James Ubbe Anderson, Ph.D.
Purdue University, 1957

Major Professor: Joe L. White

A study was made of the factors contributing to the physical properties of some fragipans. Detailed mineralogical and chemical examinations were made of one soil profile with a fragipan and a second soil formed from a similar parent material under similar conditions but less highly weathered and not having a fragipan.

The highly weathered profile was found to have large amounts of extractable aluminum above the fragipan, but little aluminum and traces of soluble silica within the fragipan. Only small amounts of aluminum were extracted from the profile without a fragipan.

The quantities of iron and aluminum present as oxide coatings were determined. No accumulation of oxide coatings per unit area of surface was found in the fragipan. Vacuum-wetted pieces of a fragipan were found to break down in sodium hydrosulfite or sodium citrate solutions, but not in an acetate buffer solution with a pH of 4.5 or a neutral sodium chloride solution. The breakdown in solutions which reduce or complex iron and the absence of such results from the other solutions indicated that iron oxide cementation was involved and that neither cementation by aluminum oxide nor the effect of exchangeable cations was of primary importance.

The possibility of cementation by an organic material was considered. However, dry combustion analyses showed that the fragipan contained very little carbon.

The extent to which the montmorin of the fragipan profile was capable of expanding was investigated using X-ray diffraction to determine the extent of solvation by ethylene glycol after oxide removal, after sodium hexamataphosphate dispersion, and after no sample treatment. Oxide removal was very effective in the horizon above the fragipan, but was much less effective than the dispersion technique in the fragipan. This showed that iron cementation also existed above the fragipan, and that the montmorin of the fragipan may be kept from expanding by exchangeable iron which is precipated as a phosphate by the dispersion technique.

The quantities of various minerals present in the 1-2 μ clay from the various horizons of both profiles were estimated from X-ray diffraction patterns made after solvation and heat treatments. The ratios of first to second order diffraction intensities from illitic minerals was shown to vary greatly both between and within the profiles. This appeared to be the result of varying octahedral substitutions, and was taken as evidence of synthesis of these minerals in these profiles.

Differential thermal analyses were made using clay from the horizons of the soil profile with a fragipan both with and without treatment to remove oxides.

The following conclusions were reached:

1. The fragipans are cemented by iron oxides.
2. These horizons have a lower montmorin content than horizons of comparable depth in a similar profile without a fragipan. At least part of this appears to have been formed in the soil profile.
3. Only a small amount of the montmorin of these horizons is capable of expansion under normal conditions.

99 pages. $2.00. Mic 57-2981

CHARACTERIZATION AND AVAILABILITY OF PHOSPHORUS IN CALCAREOUS SOILS

(Publication No. 22,316)

Johan Arnold Asleson, Ph.D.
The University of Wisconsin, 1957

Supervisor: Emeritus Professor Emil Truog

The surface soils of the arid and semi-arid regions of the United States generally contain up to five per cent of calcium carbonate. They are therefore called calcareous. Because of the presence of this calcium carbonate, much of the phosphorus in these soils probably exists as several forms of calcium phosphate. In non-calcareous soils of humid regions, calcium phosphates are usually quite available. Nevertheless, many of the soils of arid and semi-arid regions are deficient in available phosphorus.

The nature of most of the phosphorus in eight calcareous Montana soils was determined in successive extracts of acid and alkali solutions. Inorganic phosphorus soluble in 0.002N H_2SO_4 of pH 3.0 was found to make up from 49.7 to 76.3 per cent of the total inorganic phosphorus. The amounts of phosphorus in this fraction were not correlated with soil pH, calcium carbonate content, or total soil phosphorus, but when expressed as percentages of the total inorganic phosphorus, these percentages were found to be related directly to the calcium carbonate contents. Most of the phosphorus thus extracted is believed to be combined with calcium.

The alkali soluble phosphorus (soluble in a solution 0.2N with respect to both NaOH and Na_2CO_3) was found to be considerably less than the amounts commonly reported in acid soils. The amounts of inorganic alkali soluble phosphorus, probably largely iron and aluminum phosphates, were not related to soil pH, or contents of organic matter, calcium carbonate, or total phosphorus. The low values obtained indicate that in calcareous soils, iron and aluminum phosphates are not generally important sources of available phosphorus.

The amounts of organic phosphorus soluble in the cold alkali were also less than commonly reported for acid soils. These amounts were related directly to the organic matter contents, but this was not true of the organic phosphorus extracted by the hot alkali. A soil which had received much animal manure and phosphate fertilizer during the past 20 years contained very little organic phosphorus, but did contain more inorganic phosphorus soluble in 0.002N H_2SO_4 than a similar soil not manured or fertilized, indicating that organic phosphates generally do not accumulate in calcareous soils.

The difficulty soluble calcium and iron phosphates (not extractable with weak acid and alkali) were extracted with two per cent oxalic acid. These phosphates represented from 1.7 to 7.9 per cent of the total phosphorus, and are probably quite unavailable. Carbonated water extracted about 80 per cent as much phosphorus from two soils tested as 0.002N H_2SO_4, giving further evidence that most of the inorganic phosphorus exists as weak acid soluble calcium phosphate.

Growth of rye in an acid sand-amberlite medium was about three times as great when tri-calcium phosphate was the source of phosphorus rather than ferric phosphate, and the percentage of phosphorus in the tissue was quadrupled. When five per cent of calcium carbonate was

added to the medium, both yields and phosphorus contents were lowered, greatest in the case of the tri-calcium phosphate; however, in the regrowth of the rye, the ferric phosphate was much superior.

In a pot test with rye, using a soil containing 12 per cent of calcium carbonate as the culture medium, ferric phosphate was a better source of phosphorus for the first crop than either mono- or tri-calcium phosphate, but was about equal to these phosphates for the two succeeding crops. Twenty per cent superphosphate, added as 10-20 mesh granules, was definitely superior to these other phosphorus sources with all three crops, probably due to the granulation of the material.

87 pages. $2.00. Mic 57-2982

PRUNUS HOST RANGE AND POLLEN TRANSMISSION OF ELM MOSAIC VIRUS

(Publication No. 22,325)

Kemper Leroy Callahan, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor J. Duain Moore

Prunus host range studies were initiated because of the possibility of associating elm mosaic virus with one or more of the stone fruit virus diseases. Twenty-eight species or varieties of Prunus were inoculated by budding with infected elm buds. Symptoms developed on 15 of the 28 sorts, representing 13 of the 18 species tested. Most common symptom was a chlorosis and twisting of the leaf lamina, but necrosis, chlorotic lines and rings, chlorosis, and vein clearing were also observed. Virus was recovered in tobacco from 16 of the 28 sorts tested, 4 of which were symptomless carriers. When inoculated Prunus was budded back to healthy elm, virus was transmitted from 13 Prunus sorts. In all 20 of 28 Prunus sorts were infected. Those species which were not infected are considered to be immune to the virus.

Symptoms incited in certain species by elm mosaic virus were similar to those of some stone fruit diseases, but the elm mosaic virus differed in host range from known Prunus viruses. A number of local Prunus viruses could not be transmitted to elm. Therefore, it was concluded that elm mosaic virus is different from viruses reported to exist naturally in Prunus.

Presence of elm mosaic virus in pollen collected from a mosaic infected elm tree, coupled with previous reports of seed transmission, suggested the possibility of pollen transmission. In determining this, all possible combinations of pollinations between healthy and infected parents were made using cut branches forced in the greenhouse. Each of the 2432 resulting seedlings was tested for virus by inoculation to tobacco plants. Results of this investigation showed elm mosaic virus to be transmitted by means of pollen to seed produced on healthy trees.

Transmission of elm mosaic virus through the healthy pollinated flower and peduncle, and into the healthy tree was not found.

Elm mosaic virus in pollen was found to be active after 3 years storage at $0^{\circ}C$, with a higher concentration of virus in pollen stored over calcium chloride.

49 pages. $2.00. Mic 57-2983

UPTAKE OF PHOSPHORUS BY PLANTS AS INFLUENCED BY FERTILIZER CHLORIDES AND SULFATES

(Publication No. 22,365)

Edwin Louis Hobson, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor K. C. Berger

Field and greenhouse experiments were conducted to determine the effect of fertilizer chlorides and sulfates on uptake of phosphorus by a number of Wisconsin crops. Band and broadcast applications of potash salts containing chlorides and sulfates were compared in the field on potatoes and corn. In the greenhouse, potassium rate and source experiments on potatoes, corn, sugar beets, and oats were used to determine effects of chlorides and sulfates on total uptake of phosphorus and other plant nutrients.

Plant tissue samples were collected during the growing season and analyzed for nitrogen, phosphorus, sulfur, chlorine, potassium, calcium, magnesium, and silicon. The analyses were correlated to fertilizer treatment and yield. Results were calculated in me. ion per 100 grams dry tissue. Sums of cations and anions were obtained and cation/anion quotients tabulated. Presentation of the data was done in this manner to detect trends to anion and cation constancy.

The study indicates that soil moisture conditions may have an effect on anion competition, both in the field and in the greenhouse.

Above ground portions of Kennebec potatoes grown on Omega sand in northern Wisconsin showed 10 per cent lower phosphorus uptake where potash, regardless of source, was applied in a band below and to each side of the seed pieces. In the row, there were indications that potassium chloride had a more depressive effect than equivalent rates of potassium sulfate. However, rainfall during the growing season in 1956 was very high, and it is felt that leaching conditions removed some of the chloride ion from the band allowing plant roots to feed on the phosphorus with less than usual competition from chloride.

Indications of response to magnesium and sulfur were obtained both in tuber yield and tissue analyses.

With 200 pounds of 6-24-24 (KCl) per acre in the row as a starter fertilizer for corn, ear yields were depressed by a significant 15 bushels to 60 bushels per acre. This was in comparison to equivalent amounts of 13-39-0 and 6-24-24 (K_2SO_4), which produced 75 and 70 bushels, respectively. Tissue analyses revealed that phosphorus uptake depression was the probable cause. Leaf phosphorus content for the potassium chloride treatment was .35 per cent for the first and second samplings while in the tissue from the 13-39-0 treatment it was .55 per cent and .48 per cent. These differences were not apparent at maturity. Corresponding chloride values for leaf tissue were 2.5 and 1.8 per cent for the 200 pound 6-24-24 (KCl) treatment and 1.5 and 1.0 per cent for 13-39-0 and 6-24-24 (K_2SO_4). In other field experiments with corn, these differences in yield and phosphorus content were not seen. The reason lies in the fact that in the field trial reported above, for a period of three weeks after planting no rain fell. Plant roots were thus feeding on the unleached fertilizer band. In the latter field experiments the corn had ample rainfall beginning shortly after planting. It is thought that this

was enough to remove the inhibiting chlorides from the fertilizer band.

Branch oats were grown in the greenhouse in cans containing five pounds of soil. Potassium chloride, potassium sulfate, and potassium di-hydrogen phosphate were compared at three levels of applied potassium and four levels of applied phosphorus. Total phosphorus uptake in mgms was reduced 20 per cent at all levels of applied potassium and phosphorus for the potassium chloride series. In addition, there were indications that the chloride absorbed in this series was depressing sulfate uptake also.

It is concluded that chlorides will inhibit the uptake of phosphorus by plants as well as other anions. Leaching of chloride ion ameliorates this condition. High rainfall or heavy watering tends to move the chloride ion out of the fertilizer band. Phosphorus can then be absorbed by the plant with little competition from other anions. Without leaching, competition or inhibition results. In the greenhouse, use of small containers of soil results in chloride inhibition of the uptake of phosphorus because of a lack of leaching. 129 pages. $2.00. Mic 57-2984

INHERITANCE STUDIES IN PISUM SATIVUM L.

(Publication No. 22,369)

Kenneth Wadsworth Johnson, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Donald J. Hagedorn

I. The inheritance of resistance to bean virus 2 in Pisum sativum L.

The inheritance of resistance to bean virus 2 in Pisum sativum L. was studied. Each of two susceptible varieties, Perfected Wales and Thomas Laxton, were crossed to each of four resistant varieties, New Era, Pride, Wisconsin Early Sweet and Wisconsin Perfection. The reactions of reciprocal F_1 hybrids, bulk F_2 and F_3 progeny populations of these eight crosses were tested for reaction to bean virus 2 in the greenhouse. Some of the crosses were also classified for internode length to determine if linkage was present between the two factors.

Results of testing the above populations indicated that resistance was inherited as a single recessive gene. Cytoplasmic inheritance was not present and the gene for internode length was independent of the bean virus 2 reaction gene. Discrepant results in some of the F_2 bulk and heterozygous F_2 and F_3 progeny classes were attributed to a probable delayed symptom expression in the heterozygotes.

II. Genetic and environmental variability in Pisum sativum L.

The inheritance of 13 quantitative characters was studied in three pea (Pisum sativum L.) crosses of Alaska x Wisconsin Early Sweet, Alaska x Wisconsin Perfection and Black-Eyed Susan x Wisconsin Early Sweet. The parental, F_1 and F_2 populations of each cross were space planted in two replications of a randomized complete block design. Records of each character were made on an individual plant basis. Gene action, heterosis and dominance relations were estimated. Heritability, the ratio of genotypic variance to phenotypic variance, was determined using the average variation of the two parents and F_1 as a measure of environmental variance. Phenotypic, genotypic and environmental correlations between all the characters were calculated. Yield was also partitioned into its component parts and data on the interrelationships of these components was presented.

The results indicated that genes for low yield, small number of peas, low number of pods, and low average seed weight were partially dominant. Heterosis and transgressive segregation for all four characters were observed. Flowering time and number of nodes to the first pod were probably determined by one or two major genes, plus partially dominant modifiers for late flowering and large number of nodes to the first pod. Plant height, internode length and total number of nodes were probably genetically related. Internode length was controlled by one or two major genes pleiotropic for plant height. The number of nodes appeared to be determined by a number of modifiers partially dominant for high node number. Heterosis in plant height was attributed to the over-all positive increment due to increased vigor in the F_1.

Heritability values and genetic gains were, in general, low to intermediate in Alaska x Wisconsin Early Sweet and intermediate to high in the other two crosses. Selection in the F_2 and genetic advance under selection should be effective in improving yield, number of peas, number of pods, average seed weight, plant height, flowering time and the number of doubles above that of the highest parent.

Phenotypic, genotypic and environmental associations indicated a positive relation between yield, number of peas or number of pods and plant height, internode length, number of nodes to the first pod node, total number of nodes and number of double pods.

In general, phenotypic correlations were either nonsignificant or in the same direction and magnitude as the genotypic correlations. Genotypic correlations indicated that seven characters would be of practical value in selecting for yield, number of peas, number of pods, average number of peas per pod and average pea weight. Environmental correlations were either of low magnitude or in the same direction as the genotypic correlations.

Yield component relationships showed that variation in yield is due primarily to variation in number of pods and total number of peas per plant. Average seed weight and average number of peas per pod had only a slight influence on yield and number of peas respectively. Yield, number of pods and total number of peas per plant were probably pleiotropic manifestations of the same set of genes. Average seed weight appeared to be linked with yield, number of peas and total number of peas per plant in Alaska x Wisconsin Early Sweet and in Black-Eyed Susan x Wisconsin Early Sweet. In the latter cross, standard partial regression coefficients showed a slight positive relationship between average seed weight and yield. However, the simple correlation coefficient between average seed weight and yield, irrespective of the number of peas, was negative. 113 pages. $2.00. Mic 57-2985

RECOVERY OF RECURRENT PARENT CHARACTERS FROM CROSSES OF SOLANUM DEMISSUM X S. TUBEROSUM IN SUCCESSIVE BACKCROSSES

(Publication No. 22,463)

Florian Isadore Lauer, Ph.D.
University of Minnesota, 1957

Two series of F_1, BC_1, BC_2 and BC_3 progenies of S. demissum x S. tuberosum were grown. In one series the S. tuberosum parent clone used was an S_3, 15-2-10-1-2, and in the other an S_0, 528-170. Backcross progenies to the S. demissum and the S. tuberosum parents were studied in both series.

Progenies from seed were grown in three greenhouse tests. Tubers from the seedling generation were used to grow a clonally propagated generation of the progenies in three field tests. Objective measurements were made on seventeen seed, vine, and tuber characters. In both greenhouse and field tests, the completely randomized block was used as the major experimental design.

For the F_1 progeny of S. demissum x S. tuberosum using the S_3 generation parent, 15-2-10-1-2, the means of the foliage characters were generally higher than those of the selfed progenies of either parent. The means of the F_1 for tuber characters were similar to those of S. demissum. In successive backcrosses to 15-2-10-1-2 the mean values progressively changed from the F_1 toward those of the recurrent parent and closely approached them in the BC_3.

For the F_1 progeny of S. demissum x S. tuberosum using the S_0 generation parent, 528-170, the means of foliage and tuber characters were equal or lower than those of the selfed progenies of either parent except for seed weight, length of cotyledons, length of longest leaf and number of leaflets per leaf. These were higher than either parent. Means of the BC_2 and BC_3 progenies were approximately equal to those of the recurrent parent, 528-170.

Higher mean values were obtained in the F_1 from crosses of S. demissum with the S_3 than with the S_0 parent for all characters studied except one foliage character. The distinct differences in mature stem length, number of secondary branches, length of longest leaf, number of leaflets per leaf, length and width of largest nonterminal leaflet, tuber set and tuber yield between the selfed progenies of the two S. tuberosum parents were present in their respective BC_3 progenies.

For the backcross progenies with S. demissum as the recurrent parent, the means of foliage characters tended to be higher in the BC_1 and similar in the BC_2 compared to those of the selfed progeny of S. demissum. Approximately one-half of the BC_2 plants set seed as liberally as S. demissum. 91 pages. $2.00. Mic 57-2986

COMBINING ABILITY OF ALFALFA CLONES FOR SEASONAL GROWTH RESPONSES AND FORAGE YIELD

(Publication No. 22,464)

William Mason Lewis, Ph.D.
University of Minnesota, 1957

Adviser: W. M. Myers

An important problem in alfalfa breeding is the evaluation and selection of superior clones which combine well.

Eleven alfalfa clones, 104 of the possible single crosses among the 11 clones, 10 open-pollination progenies of the clones, and 9 commercial varieties were evaluated for seasonal growth responses; earliness of spring growth, recovery rate after cutting, fall dormancy, erectness or type of growth, and degree of bloom; and forage yield. Visual notes for seasonal growth responses were taken on an individual plant basis and forage yield was taken on a plot basis and recorded as pounds green weight.

The results of this study indicated that clones, single crosses, and open-pollination progenies differed for seasonal growth responses and yield. There were no consistent differences between reciprocal crosses for seasonal growth responses, but nine single crosses did differ from their reciprocal cross in yield.

For seasonal growth responses, single crosses between clones receiving a high rating tended to have a high rating, single crosses between clones receiving a low rating tended to have a low rating, and single crosses between a clone receiving a high rating and a clone receiving a low rating tended to have an intermediate rating.

With respect to ratings for seasonal growth responses, there were significant correlations between clones and the average of the single crosses of the clones used as female parents and between open-pollination progenies and the average of the single crosses of the clones as female parents. Since actual single-cross performance was considered the most reliable method for evaluating clones, these relationships indicated that clonal progeny and open-pollination progeny gave a satisfactory evaluation of the general performance of the clones. On the other hand, clonal yield was not an indication of the yield of the progeny of a clone. The yields of the open-pollination progenies were highly significantly correlated ($r = 0.883$) with the average of the single crosses of the respective clones.

Genotypic correlations among spring vigor, recovery rate after cutting, and fall dormancy of the entries revealed that a clone, a single cross, an open-pollination progeny, or a commercial variety tended to perform similarly throughout the growing season.

Both significant and non-significant genotypic correlations were obtained between spring vigor, recovery after cutting, and degree of bloom of the entries and forage yield of the entries. The significant correlations ranged from 0.217 to 0.781. Fall dormancy and erectness were not correlated with yield.

General combining ability of the 11 clones was evaluated by the average forage yield of the single crosses of a clone used as a female parent and the yield of the open-pollination progenies. Differences were found among the clones for general combining ability. Minn. 247, Minn. 265, and Minn. 271 were the outstanding general combiners.

Thirty-two single crosses showed good specific combining ability. In the majority of the crosses showing good specific combining ability, one or both parents had good general combining ability.

The exhibition of specific combining ability among the clones illustrated the importance of considering specific combining ability when a few clones are to be combined into a synthetic variety. Also, the high specific combining ability of certain clones illustrated the possibilities of producing a high yielding single-cross hybrid in alfalfa. 154 pages. $2.05. Mic 57-2987

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

THE ROOT ACTIVITY OF SUBIRRIGATED ALFALFA AS RELATED TO SOIL MOISTURE, TEMPERATURE AND OXYGEN SUPPLY

(Publication No. 22,134)

Roy Clarence Lipps, Ph.D.
The University of Nebraska, 1957

Adviser: Harold F. Rhoades

A field experiment was initiated in 1954 to develop a radioactive tracer method for characterizing the root activity of the alfalfa plant. Two methods of P^{32} placement, A and B, were compared on an established stand of subirrigated alfalfa on a Wood River soil having a water table at eight feet. Placement method A consisted of drilling 36 equally spaced 1 1/4-inch holes in a plot 3x3 feet in size. One gram of radioactive fertilizer was placed at the bottom of each hole. Placement method B consisted of drilling nine equally spaced 3-inch holes in a plot 3x3 feet in size. Three grams of radioactive fertilizer was mixed with a 6-inch increment of soil and the soil-P^{32} mixture returned to the hole. Seven placement depths were selected from the soil surface to the water table for the two methods.

A measure of the root activity of alfalfa was obtained from the amount of P^{32} absorbed from the radioactive phosphorus fertilizer placed at various depths in the soil. Sufficient P^{32} was absorbed to give a record of seasonal root activity with both placement methods. Absorption of P^{32} from the various depths appeared to be related to favorable moisture and temperature environment. More uniform phosphorus uptake data was obtained from placement method A.

A greenhouse experiment was carried out to assess the magnitude of errors in measured root activity arising from a differential fixation with depth of the applied radioactive phosphorus by the soil from the 1954 field experimental location. A root activity correction factor was obtained for the purpose of correcting root activity measurements. Insufficient fixation occurred to appreciably alter root activity measurements.

A replicated field experiment was initiated in 1955 which attempted to relate root activity in an established stand of sub-irrigated alfalfa to soil moisture, temperature, oxygen supply, water table fluctuation, and selected chemical and physical properties of a Hall soil. Radioactive phosphorus was placed at 17 depths from the soil surface to a 12-foot water table using fertilizer placement method A.

A greenhouse experiment, similar to that carried out on the soil from the 1954 field experiment, was conducted on selected depths of soil from the 1955 field experiment. The data from this greenhouse experiment indicated that little error in root activity measurement would be expected since only slight phosphorus fixation occurred.

Soil moisture and temperature changes appeared to have been the principal cause for root activity changes. At the beginning of the growing season, when soil moisture and temperature were most favorable in the surface soil, nearly all of the root activity was located in the upper 14 inches of soil. Root activity was highest at the 4-inch depth. After July 8th, high soil temperatures and no readily available moisture contributed toward an unfavorable environment for root activity in the surface layers of soil. Consequently, much of the root activity shifted to the capillary fringe above the water table where temperatures were lower and moisture was present at low tension.

A marked disparity was found between root activity and root weight. At the end of the growing season less than three percent of the total roots were found below the 7-foot depth, yet these roots contributed nearly two-thirds of the total root activity.

The large amount of macro- and micro-pores available for gaseous diffusion and measured oxygen values indicated that the soil investigated was well aerated. Soil oxygen percentage appeared to be related to total root activity and to the distance through which the gas had to diffuse. 160 pages. $2.10. Mic 57-2988

THE INDUCTION AND EVALUATION OF ENDOSPERM MUTATIONS IN MAIZE

(Publication No. 22,280)

Nihal Kishinchand Notani, Ph.D.
Purdue University, 1957

Major Professor: H. H. Kramer

Experiments were conducted to induce endosperm mutations that could be used directly or indirectly in interactions, enhancing the amylose fraction of the ordinary corn. To achieve this, use was made of ultraviolet rays and the intranuclear system of controlling elements, Ds-Ac (Dissociation-Activator).

Treatment with ultraviolet rays was carried out on two stocks, one an inbred (M-14), the other a single cross (CC5/L317). Freshly collected pollen was spread in a single layer on glass slides and treated from above at a distance of 12", with a "whole spectrum" model cold quartz lamp. The inbred was treated for 4', 6', 8', and 10'. All the treatments and pollinations were done on one date. The single cross had an additional treatment of 12'. The treatments and pollinations were carried out on three different dates. The F_1 plants were self-pollinated and the mutations screened in the F_2.

Stocks carrying Ds-Ac elements were crossed as pollen parents to a commercial sugary stock and a single cross dent (CC5/L317). It was presumed that during the growth of these plants some transpositions of Ds to new locations would occur, inducing instability at some adjacent loci. F_1 kernels arising from the sugary outcross were scored for sugary sectoring. Selected kernels were planted and the plants self-pollinated. The F_2 progeny were screened with regard to the true-breeding behavior of the selected kernels. The F_1 kernels from the dent outcross were planted and selfed.

A direct effect of the ultraviolet rays was observed on the size of the seed produced by pollination with the treated pollen. Weight per seed decreased with added increments of the dose. The decline was consistant and progressive in the case of the inbred, but somewhat inconsistent in the case of the single cross.

The percent mutation in the inbred declined with higher doses than 4'. It was thought that higher doses probably damaged the pollen sperm nuclei to the extent of their exclusion in the F_0 or F_1. The majority of the mutations appeared to be of the defective type. Seedling tests with

some of them gave in general smaller seedlings than normal. This was attributed to general comparative smallness of the mutant endosperms.

The mutations induced in the single cross did not show any decline of the rate with additional doses. The nature of this buffering capacity as compared to the inbred was not clear. Although the average rate of mutation was somewhat higher than 10%, the majority of the mutations were of the defective type.

The sugary x Ds-Ac cross gave two sugary mutations. One of them appeared not to be due to Ds-Ac, as the Ds activity appeared to be present at the standard locus. The other mutation, however, did not show any such activity. In addition, it showed seven starchy kernels which were thought to be due to germinal reversions of the Ds-Ac induced sugary mutation.

Another ear showed a ratio of 3 sugary : 1 starchy. Two possible explanations were given: change in the Su locus brought about by Ds-Ac so that it acts as a recessive to su; or, mass reversion of a Ds-Ac induced mutation at the sugary locus due to their occurence in a sector of sporogenous tissue.

The single cross x Ds-Ac cross also gave two texture mutants. One was called translucent and had at least 8% higher amylose than normal. The other was a floury mutant. Methods concerning the establishment of Ds-Ac control of these mutations and their utilization were outlined. A method for rapid screening of the Ds-Ac induced mutations was also suggested.

From the F_2 dent outcross data, the position of Ds in the original stock was located 10.89 map units to the right of waxy. It was also found that the sectoring found in the F_1 of the sugary outcross was not due to Ds.

96 pages. $2.00. Mic 57-2989

GENETIC CONTROL OF STARCH PROPERTIES IN MAIZE

(Publication No. 22,286)

Paul Leighton Pfahler, Ph.D.
Purdue University, 1957

Major Professor: Herbert H. Kramer

A heating stage for the determination of birefringence endpoint temperatures of starch granules was designed and tested.

An examination of birefringence endpoint temperatures of starch granules produced by various endosperm mutants of maize was made. The endpoint temperature of one kernel from a true breeding ear of several endosperm mutants indicated that a wide range existed. The starch granules from the su_2 genotype possessed the lowest endpoint temperature in the group with a reading of approximately 55.0° C. Starch granules from the ha genotype had the highest endpoint temperature of approximately 85.0° C. The starch granules from the normal and waxy genotypes had endpoint temperatures of approximately 68.0° C.

Dosage effects on endpoint temperature were also exhibited by the genes su_2, ha and du. The gene ha in increasing doses in the endosperm raised the endpoint temperature of the su_2 genotype. The gene du in increasing doses lowered the endpoint temperature of the ha genotype.

The practical value of endpoint temperature determinations to separate genes with similar phenotypic effects was shown. In a segregating population of su_2 and ha, it was found to be possible to separate each phenotype and in succeeding generations, each genotype. Phenotype did not appear to be strongly correlated with genotype.

Many genotypes were found to have equal or approximately equal endpoint temperatures when mounted in water. It was shown that by using different salt solutions in various concentrations, interaction occurred so that separation of these genotypes was possible.

The mean diameter of the starch granules produced by the genotypes wx, normal, su_2, ha, du and combinations of su_2, ha and du was considered to be independent of the birefringence endpoint temperature.

Maturity studies on the suha genotype indicated that the amylose percentage rose markedly from the 21 days after pollination period to the 28 days after pollination period. After the 28 days after pollination period until maturity, the amylose percentage remained relatively constant. No large change in the birefringence endpoint temperature occurred in any stage of maturity. The number of grains refracting and the refraction quality of the grains decreased markedly as maturity was reached.

No definite conclusion could be made regarding the relationship between the birefringence endpoint temperature and amylose percentage.

A model for the differentiation of amylose and amylopectin in starch synthesis was proposed and discussed. In this model, amylose present in mature corn, is considered to be derived from a breakdown of the amylopectin molecule. The implications of this model regarding the birefringence endpoint temperature phenomenon was discussed.

123 pages. $2.00. Mic 57-2990

THE INFLUENCE OF LIGHT INTENSITY, QUANTITY, AND ILLUMINATION PERIOD ON THE GROWTH OF LEGUME SEEDLINGS

(Publication No. 22,290)

Charles Loren Rhykerd, Ph.D.
Purdue University, 1957

Major Professor: R. G. Langston

Despite our recent advanced knowledge of the soil requirements of individual forage crops, improved methods of seeding, more efficient strains of nitrogen-fixing bacteria, seed treatment for soil-borne diseases before sowing, and improved varieties, seeding failures are still quite frequent. In order to solve these problems, detailed studies of the fundamental principles of plant growth on various soil types and under different climatic conditions are needed. The purpose of this investigation was to study the influence of light intensity, quantity and illumination period on the seedling growth of alfalfa Medicago sativa, red clover Trifolium pratense and birdsfoot trefoil Lotus corniculatus.

Ten days after seeding, the legume seedlings were subjected to various light treatments for 15, 30 and 45 day

growth periods. The light treatments consisted of light intensities ranging from 100 to 3200 f.c. The plants were subjected to different illumination periods which will be referred to as illumination periods A, B and C. Illumination period A consisted of a light period of 12 hours a day at a constant light intensity. Illumination period B was also a 12 hour light period but the light intensity was low for 8 hours and high for 4 hours in order to obtain the same number of foot candle-hours per day as the corresponding treatment at a constant light intensity for 12 hours a day. Illumination period C consisted of a constant light intensity for 6 hours a day. However, the light intensity of illumination period C was twice the intensity of illumination period A in order to obtain the same number of foot candle-hours of light per day.

The growth response of legume seedlings to increasing light quantity in the range of 2400 to 19,200 foot candle-hours per day was curvilinear. The manner in which a given quantity of light is received by a plant is important. It was found that a 12 hour illumination period at a constant light intensity is more efficient in producing increased dry weight than the same light quantity for 12 hours but at several different intensities. This is particularly true above a light quantity of 4800 foot candle-hours per day. Only at a light quantity less than 4800 foot candle-hours per day is a higher intensity for a short period of time as efficient as a long illumination period at a lower intensity. The difference in response of the three legume seedlings to various light treatments is significant. Birdsfoot trefoil seedlings produced less top and root growth under all light treatments than alfalfa and red clover. The difference in response of alfalfa and red clover is mainly accounted for by the difference in response of the roots of the two species to various light treatments, especially intensity. Red clover produces greater root growth than alfalfa at low intensities, up to 400 f.c. with a 12 hour illumination period, and less at higher intensities.

Light intensity has a pronounced effect on the leaflet/stem ratio of legume seedlings. The leaflet/stem ratio of alfalfa and red clover is high at low light intensities and rather low, less than 1, at high intensities. Birdsfoot trefoil seedlings appear to respond just the opposite of alfalfa and red clover. The leaflet/stem ratio of birdsfoot trefoil seedlings is low at low light intensities and becomes higher with an increase in intensity. However, as the seedlings become older, the leaflet/stem ratio decreases at higher light intensities. At the end of a 45 day growth period, the leaflet/stem ratio of alfalfa, red clover and birdsfoot trefoil is approximately the same at 3200 f.c. for 12 hours a day.

The difference in the relative rate of uptake of CO_2 by birdsfoot trefoil seedlings as compared to alfalfa and red clover is highly significant. The uptake of CO_2 by birdsfoot trefoil is considerably lower under all light treatments. A growth period in which the light intensity is constant curing the illumination period appears to be favorable for greater uptake of CO_2 than an illumination period of the same length and light quantity but at several different intensities.

120 pages. $2.00. Mic 57-2991

NEUROANATOMICAL AND NEUROPHYSIOLOGICAL STUDIES OF THE EXTERNAL GENITALIA OF THE BULL AND RAM

(Publication No. 22,494)

Lester Leroy Larson, Ph.D.
University of Minnesota, 1957

Major Adviser: Ralph L. Kitchell

The nerve supply to the external genitalia of the bull and ram has been studied using gross anatomical, histological and electrophysiological approaches.

The central origin of this nerve supply falls into three groups, cranial, middle and caudal. The cranial origin includes C-8, T-1 and T-2 as well as T-9 through T-13 and L-1 and L-2. These spinal nerves contribute in part to the lateral thoracic nerve and the cutaneous rami of the ventromedial branch of the ventral primary division which are distributed in the area of the protractor and retractor preputiae muscles as well as the prepuce. The middle origin is via L-2, L-3 and L-4. These spinal nerves form in part the inguinal nerve which is distributed to the lateral scrotal wall, the fold of the flank and the prepuce. The caudal origin is by far the greatest source of nerves to the external genitalia. From S-2 through S-5 the pudendal, as well as middle and caudal hemorrhoidal nerves are formed.

The peripheral distribution of the above mentioned nerves is described with illustrations. The function of each nerve has been determined in a combined histological and electrophysiological study.

The pudendal nerve, which is formed largely from S-3 but usually has a small contribution from S-2 as well as a rather consistent component from S-4, gives rise to many branches concerned with the innervation to the external genitalia. The first of these are the proximal and distal cutaneous branches. These are purely cutaneous sensory to the area of the perineum. The next branch of the pudendal nerve is the deep perineal nerve which is joined by a branch from the sciatic nerve that passes lateral to the sacrosciatic ligament. The trunk thus formed is distributed to the muscle derivatives of the cloacal sphincter of the embryo, namely, the ischiocavernosus, bulbocavernosus, and urethral muscles as well as the external anal sphincter. The pudendal nerve terminates in the dorsal nerve of the penis and the superficial perineal nerve distal to the ischial arch. The superfical perineal nerve supplies cutaneous branches to the scrotum and the prepuce. The dorsal nerve of the penis is distributed to the penis, especially the glans. Grossly dissectable branches were observed from the dorsal nerve of

the penis to the retractor penis muscle at the second bend of the sigmoid flexure. Histologically and electrophysiologically evidence has been presented which shows the dorsal nerve of the penis to contain afferent fibers of much larger diameter and conduction rate than found in purely cutaneous nerves. These fibers are considered to be from special "genital receptors" in the glans penis.

The middle hemorrhoidal nerve gives branches to the area of the anus and continues through the substance of the retractor penis muscle to be distributed to it. Electrophysiological studies have shown that the dual nerve supply to the retractor penis muscle seen grossly is actually the true source of nerve supply to the muscle.

Upon stimulation of the inguinal nerve, reflex contraction of the protractor and retractor preputiae muscles was obtained. This reflex was used to show that the nerve supply to the protractor and retractor preputiae muscles was via the lateral thoracic nerve. This was done by obliterating the reflex by transecting the lateral thoracic nerve.

The reflex discharges of the sacral ventral roots were examined upon stimulation of the dorsal roots and peripheral nerves. A proprioceptive spike was noted in all segments when the dorsal roots were stimulated but only in S-3 when peripheral nerves were stimulated.

144 pages. $2.00. Mic 57-2992

ANTHROPOLOGY

ATZOMPA: A POTTERY PRODUCING VILLAGE OF SOUTHERN MEXICO

(Publication No. 22,199)

Jean Clare Hendry, Ph.D.
Cornell University, 1957

The subject of this thesis is pottery making as it is practiced today in a small rural community in Oaxaca, a state of southern Mexico. Through a detailed analysis of the craft, there is an attempt to specify its significance in village life and to determine to what extent it can be considered an art.

The first chapter states the problem and proposes a definition of aesthetic activity as one characterized by disinterested enjoyment and the creation of new forms. There is a brief account of the folk arts of Mexico, followed by a description of the central valley of Oaxaca, its history, and the craft producing villages of the region. A final section explains how the field research was carried out in Atzompa, the role of the investigator, and the techniques employed to collect the data.

Chapter II deals with the village, sketching its major institutions. It is concluded that in most respects Atzompa is typical of the region and, to a lesser degree, of communities in other parts of the country. Its culture is a blend of aboriginal and sixteenth century Spanish patterns, the latter predominating, and is not at present undergoing fundamental changes since the area as a whole is one of the less progressive of Mexico.

Subsequent chapters are devoted to the various aspects of pottery making. There is a resume of the types of ware produced in Atzompa, their function, and what little is known of their history. The processes of manufacturing pottery are described: the division of labor, individual specialization, the weekly work cycle, and techniques utilized by the potters. A chapter on economics discusses different methods of marketing, price and its determinants, costs of production, and profits. There is an examination of the manner in which the potters acquire their skills, their opinions about learning and differences in ability, their motives for taking up the craft, and their attitudes toward it. Finally, pottery making is considered from the standpoint of art, and the potters' creativity assessed in terms of innovation, the extent to which they invent new forms rather than reproduce old ones. The way in which they respond to photographs of the ware is analyzed to discover if there is an aesthetic component in perceptions and evaluations.

Briefly summarized, the results of the study are that pottery making in Atzompa is not an aesthetic activity: there is a low incidence of innovation, little enjoyment of the work for its own sake, and little tendency to regard the pots as art forms. The function of the craft in the village is rather that of an economic institution since, along with agriculture, it provides the basis of subsistence and is practiced in 90 per cent of the households. Although a domestic industry carried out by the women with hand methods quite probably dating back to the pre-Conquest period, it is a large scale commercial enterprise in which utilitarian articles and some specialties for the tourist trade are made in quantity, sold to merchants in Oaxaca city, and distributed throughout the state.

It is chiefly due to the pressures engendered by mass production that creativity is inhibited and satisfactions other than those of a monetary nature are slight. The pottery is regarded by the villagers as arduous, dirty, and monotonous, but most have worked at it since childhood and recognize few alternatives as a means of earning a living.

321 pages. $4.15. Mic 57-2993

KU DAENG -- THE RED TOMB: A VILLAGE STUDY IN NORTHERN THAILAND

(Publication No. 22,200)

Konrad Kingshill, Ph.D.
Cornell University, 1957

The village of Ku Daeng lies in Sarapi District immediately to the south of the city and in the province of Chiangmai in northern Thailand. It is a typical rice-growing community with a population of approximately 850.

During the period of 1953-54, the writer was engaged in

a research study of Ku Daeng village, which provided the material for this thesis. With the assistance of northern Thai ("Lanathai" or "Lao") acquaintances he was able to maintain year-round residence in the village, and was thus in a position to observe the calendrical cycle of social, economic and religious events which go to make up the life of the average cultivator of northern Thailand.

The chief purpose of such a study was to provide a source of ethnographic data comparable to that being gathered by other anthropological field investigators in villages elsewhere in Thailand, particularly those in the Central Plain. To this end, particular attention has been paid to the problems of culture change and receptivity thereto, the village status hierarchy and the role of Buddhist religious institutions, although these considerations have been embodied in such standard chapter topics as "Economy," "The Family," "Education," "Government," etc.

Emergent from the study has been a group of implicit "themes" which seem to characterize the life of the northern Thai rice-farmer. These have been adduced to be seven in number and are comprehended under the rubrics of "utility," "profit," "fun," "individuality," "communal responsibility," "Do Good, Receive Good. . ." and "playing it safe."

Extensive appendices include tables on age and sex distribution of the Ku Daeng population, based upon a village census; kinship terminology; age and sex roles; the village prestige hierarchy, as revealed in a questionnaire administered by the writer; biographies of selected villagers; a group of typical Buddhist "sermons" in translation; and a glossary of Thai words.

The thesis reveals that while knowledge of the outside world remains vague and inchoate for the average northern Thai villager, his patterns of communication have become such that he is at least aware of life beyond the confines of his own particular milieu. Moreover, he is already accustomed to accepting some of the technological appurtenances of a distinctly different way of life and is anything but loath to abandon or at least supplement indigenous behavior patterns when they appear to become obsolete. There is, in short, a receptivity to change in Ku Daeng which has persuaded the writer to anticipate a continuing assimilation of external cultural influences as they are brought to the villagers via the Thai Government's educational and administrative staff lines.

551 pages. $7.00. Mic 57-2994

THE VALUE APPROACH: A FRAMEWORK FOR THE COMPARATIVE ANALYSIS OF CULTURES

(Publication No. 22,206)

Vangala Jaya Ram, Ph.D.
Cornell University, 1957

The thesis of the dissertation contains the following points: (a) Most of the ethnographies available to date, and there are a great many of them, are characterized by a descriptive emphasis, without much systematic analysis or interpretation; (b) The descriptive account of cultures is generally broken up into traditional institutions or "aspects" of culture such as Religion, Material Culture, and Social Organization; (c) The descriptive bias and artificial breakdown of the material can be avoided by an analytical theoretical framework; (d) Such an analytical theoretical framework, conceived preferably in terms of values, would make possible the comparative analysis of cultures, which, in turn, would enable the formulation of laws with cross-cultural validity, without which there cannot emerge a true science of anthropology.

While it was recognized that several analytical schemes have been proposed in recent years, two of these were chosen for intensive examination and application: (1) Harold Lasswell's value-analysis scheme; and (2) Morris Opler's theory of themes. A critical discussion of the theoretical framework in each case was followed by an extensive application to empirical materials. The emphasis was on the application rather than on an elaboration or refinement of the theoretical frameworks, because it was felt that neither these two nor many of the other schemes that have been proposed for this purpose have been given sufficient trial. There has been a tendency to build up schemes in the abstract without a corresponding interest in seeing whether these schemes can actually work and, if so, whether they are suitable vehicles for the comparative analysis of social structures.

Lasswell's value-analysis scheme was applied to empirical data from a sub-culture in India. An attempt was also made to bring out the main "themes" in Indian culture as a whole, and see how far the organization of the material into "themes" seemed adequate. In both cases the application was done on material from a complex, modern culture because it was felt that that would be a real test of the applicability.

The possibility of a synthesis of the two schemes was discussed but it was concluded that such a synthesis, if at all possible, would be prejudicial to both. The main need, it was felt, was to demonstrate the applicability of the schemes rather than to propose new ones.

It was found that both the value-analysis scheme of Lasswell and the theory of themes were capable of being applied to Indian materials, and that they gave an insight into Indian culture that the descriptive categories of a traditional ethnography could not. By directing attention to the main value-emphases, they were found to be especially suitable for a comparative analysis of cultures.

293 pages. $3.80. Mic 57-2995

A STUDY OF SOME OF THE METABOLIC ASPECTS OF HOST-PARASITE INTERACTION USING THE BABY CHICK AND SALMONELLA PULLORUM

(Publication No. 22,666)

Elmo Sharber Dooley, Ph.D.
The University of Tennessee, 1957

Major Professor: D. F. Holtman

The role of endotoxin in the pathology of a gram-negative bacterial infection has been studied in a model host-parasite system involving the baby chick and S. pullorum.

Alterations in the amino acid metabolism, nitrogen excretion patterns, and the concentrations of selected reactants have been studied in chicks intoxicated with the specific endotoxin of S. pullorum. These alterations have been correlated with the metabolic and physiological changes in the chick which are characteristic of pullorum disease.

The concentrations of the essential amino acids arginine, glycine, and methionine have been found to be reduced in the blood and liver of intoxicated chicks during the experimental period. These reductions in the concentrations of the amino acids were accompanied by increases in the concentrations of urea, uric acid, creatine, and ammonia in the blood of intoxicated chicks. Blood sugar and the serum inorganic phosphorus increased during experimental intoxication, while the hemoglobin concentration was found to be decreased.

The administration of glycine to intoxicated chicks resulted in an extension of survival time and prevented, at least in part, the reduction in hemoglobin concentration in latter stages of the experimental period.

The administration of arginine to intoxicated chicks resulted in an extension of survival times and produced corresponding increases in the concentrations of blood urea. The increased blood urea concentrations were marked by a concomitant reduction in the levels of ammonia in the peripheral blood of chicks intoxicated with the endotoxin of S. pullorum.

On the basis of the results of this investigation, a hepatic system has been proposed which accounts for the disappearance of arginine, glycine, and methionine. The hepatic system, as proposed, included the reactivation of the Krebs "ornithine cycle" in the liver of the experimental chick through the action of endotoxin. The participation of arginine in this cycle and in the biosynthesis of creatine, appeared to permit the removal of ammonia from the blood by converting it into urea and creatine. The protective effect of arginine appeared to be exerted in this manner. In addition, blood ammonia appeared to be converted into uric acid in the livers of chicks intoxicated with endotoxin at an increased rate.

The concentrations of citrate were measured in the livers of normal and intoxicated chicks. Citrate appeared to accumulate in the livers of intoxicated chicks and this alteration was accepted as evidence of a block in the tricarboxylic acid cycle attributable to the action of the endotoxin.

The concentration of coenzyme A was found to be reduced by the injection of endotoxin into chicks. It appeared, on the basis of these results, that the effective entry of pyruvate into the tricarboxylic acid cycle was prevented through the action of endotoxin.

The results of this investigation on the mode of action and the metabolic changes produced by endotoxin suggested disturbances in the phosphorus metabolism of the chick. Also, the disturbances in the metabolic processes of the chick suggested that oxidative phosphorylation was inhibited by endotoxin. It appeared that the regeneration of high energy phosphorus compounds was inhibited by the action of endotoxin, which in turn resulted in the inhibition of phosphorylation and other energy requiring reactions in the oxidative assimilation of carbohydrates and other metabolites.

The possible role of endotoxin as a biochemical determinate of gram-negative bacterial diseases is discussed.

101 pages. $2.00. Mic 57-2996

THE EFFECT OF ANTIBIOTICS UPON LACTOBACILLUS ACIDOPHILUS AND OTHER LACTOBACILLI

(Publication No. 22,339)

Robert Homer Ellis, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor William B. Sarles

The effect of antibiotics upon Lactobacillus acidophilus and other lactobacilli was tested in vitro and in vivo. Studies were made of the influence of antibiotics and of L. acidophilus concentrate upon coliforms, micrococci, and yeasts inhabiting the gastro-intestinal tract of man as shown by their presence in feces.

Preliminary experiments revealed the ability of pure cultures of L. acidophilus to grow on the surface of Lactobacillus Selective Agar (Baltimore Biological Laboratories) in petri dish cultures incubated in an oat jar, or in an atmosphere of CO_2. Isolation of lactobacilli from the mixed microbial flora of raw milk or of human feces was achieved by use of these conditions of cultivation. Fermentation of carbohydrates by these lactobacilli of fecal origin was determined with the replica plating technique which made possible a rapid and accurate assay of a large number of isolates.

The replica plating technique was useful for the selection and isolation of spontaneously occurring, streptomycin-resistant, one-step mutants. Tetracycline-resistant

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mutants, which "build-up" a stepwise, "penicillin-type" resistance, were isolated by repeated doubling of the concentration of antibiotics in LBS broth tubes, or by the Szybalski, "gradient plate" technique.

Lactobacilli isolated from feces were screened for antibiotic resistance by the replica plating technique. The levels of resistance of all isolates were tested simultaneously against different concentrations of chloramphenicol, penicillin, tetracycline, and streptomycin. Both LBS agar replica plate tests and LBS broth tube tests proved that the isolates were true, resistant, fecal lactobacilli. These antibiotic-resistant mutant isolates maintained their resistance throughout a six month period of study. The only difference between the resistant mutant, and antibiotic-sensitive, parent cultures was the slower growth rate of the former.

Orally administered antibiotics influenced the numbers of lactobacilli, coliforms, micrococci, and yeasts present in fecal samples collected from 50 hospitalized patients. However, the degree of influence upon these microorganisms varied with each patient. Tetracycline, chloramphenicol, and a penicillin-streptomycin combination most effectively altered the fecal flora.

The lactobacilli increased in numbers in the feces of several patients when the antibiotic regimen was continued over a period ranging from several days to several weeks. Replica plating of isolates from these patients revealed increases in numbers of antibiotic-resistant lactobacilli in feces. However, an increase in the level of antibiotic resistance of the Lactobacillus flora which was detected in the fecal samples of several patients when antibiotic treatment was continued, was not always associated with an increase in the numbers of fecal lactobacilli. In most instances, oral administration of antibiotics lowered the numbers of lactobacilli in feces.

The failure of antibiotics to decrease the fecal coliform population of feces was explained by a "shift" from a normal predominance of Escherichia coli to predominance of antibiotic-resistant, paracolon intermediates; Proteus spp., or Aerobacter aerogenes. This shift in the coliform flora occurred in the feces of the majority of the patients undergoing antibiotic treatment. The return to predominance of E. coli in the fecal flora occurred gradually when therapy was continued.

An increase in the numbers of yeasts and micrococci was found to occur in the feces of several patients receiving orally administered antibiotics. No change in numbers of these organisms was found in the feces of others.

The oral administration of L. acidophilus for short periods of time did not influence the numbers of coliforms, yeasts, or micrococci present in the feces of 11 patients; however oral administration of L. acidophilus maintained large numbers of this species in the feces of patients receiving oral dosages of antibiotics. These lactobacilli, which were not resistant to the antibiotics being administered, were "transients" in the intestinal tracts of the patients. 184 pages. $2.40. Mic 57-2997

CALCIUM AND PHOSPHORUS METABOLISM OF AZOTOBACTER VINELANDII

(Publication No. 22,342)

Raymond Gabriel Esposito, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Perry W. Wilson

An investigation of the function of calcium in the metabolism of Azotobacter vinelandii O revealed that it was concerned in reactions dealing with the formation and transfer of high energy phosphate groups. Calcium ions are required for the formation of metaphosphate by phosphorus starved azotobacter cells. The kinetics of metaphosphate formation has been studied with the radioactive isotope P^{32} added as orthophosphate. It was found that the acid insoluble metaphosphate fraction has a higher specific activity than any other fraction of the cell with the exception of orthophosphate. This observation indicates that the acid insoluble metaphosphate may be a primary acceptor of phosphorus fixed by oxidative phosphorylations of the electron transport system or substrate level phosphorylations such as that occurring in the conversion of α-ketoglutarate to succinate. There appear to be two types of labile phosphate in the acid insoluble fraction. One is metaphosphate precipitable by the addition of barium at pH 4.0 and the other is of an unknown constitution not precipitated by barium at this pH.

Calcium and the acid insoluble labile phosphate fraction have been localized by ultracentrifugation and found to be concentrated in the large particles sedimented at 7,000 x G.

Calcium stimulates oxidative phosphorylation of cell free preparations of phorphorus starved azotobacter, and it is the most active of the metals tested for the incorporation of phosphorus from added ATP into the acid insoluble non lipid fraction of cell free preparations. This material is generally considered to be an energy store of the cell. There appear to be two types of labile phosphate compound in this fraction. One type, metaphosphate, is formed in the presence of calcium and is apparently involved in nitrogen fixation. The other labile phosphorus compound appears to require magnesium for its formation. Its presence explains the effect of magnesium on the incorporation of P^{32} from ATP into the acid insoluble non lipid fraction.

Oxygen uptake of calcium deficient cultures in Burk's sucrose medium is stimulated by the addition of calcium ions. The stimulation is insensitive to azide, indicating that the increased respiration is not via the cytochromes.

The function of calcium in nitrogen fixation by A. vinelandii appears to be in the formation of labile polymeric phosphate compounds which are required for the production of acetate or a related compound. The addition of acetate or ethyl alcohol to Burk's nitrogen free medium eliminates the requirement for calcium of nitrogen fixation by the organism. The tricarboxylic acid cycle intermediates, succinate and malate, replace the requirement for calcium of nitrogen fixation, providing sucrose is present. In the absence of sucrose, the tricarboxylic acid cycle intermediates are unable to replace the need for calcium in nitrogen fixation. This is not the result of sucrose serving as an energy source for the adaptation of the cell to the oxidation of the tricarboxylic acid cycle

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intermediates, since the addition of calcium to sucrose free media containing the intermediates results in a normal lag phase of growth.

Two possible explanations have been offered for the activity of acetate:

(a) Acetate or a compound derived from it is required as an acceptor of nitrogen from the nitrogenase system.

(b) Acetate is oxidized via an azide insensitive flavoprotein electron transport system which provides specific reduced enzymes for the reduction of nitrogen. 114 pages. $2.00. Mic 57-2998

BIOGRAPHY

NATHANIEL SOUTHGATE SHALER: A CRITICAL STUDY OF AN EARTH SCIENTIST

(Publication No. 22,159)

Walter Louis Berg, Ph.D.
University of Washington, 1957

Nathaniel Southgate Shaler geologist, educator, historian, geographer, and popularizer of science, was born in Kentucky in 1841. He attended the Lawrence Scientific School and, under the spell of Louis Agassiz, studied the natural sciences. Shaler graduated in 1862, served briefly in the Union forces in Kentucky, and then returned to Harvard to become a lifelong faculty member.

Intensely interested in a year-round schooling for students, Shaler became one of the early American leaders in the summer school movement. He began experimenting with summer school instruction in the 1870's, helped establish the short-lived Anderson School of Natural History, and became the leader in the Harvard summer school movement.

Though trained in the natural sciences, Shaler made his reputation in geology, both as an administrator of geological surveys and as an investigator. After briefly working for the United States Coast Survey, Shaler served as Director of the Kentucky Geological Survey from 1873 to 1880. Under Shaler the first systematic and diversified survey of Kentucky was begun though accomplishments fell short of the plans and his departure was marred by political criticism.

In 1884 Shaler joined the United States Geological Survey on a part-time basis, serving until 1900. In charge of the Atlantic Coast Division, Shaler ranged the Atlantic seaboard producing reports both of a theoretical and economic nature. Typical were reports dealing with the changes in the level of the shoreline and the economic importance of coastal swamps.

A prolific writer, Shaler used the technique of reproducing his reports in several forms: official reports were turned into popular articles to be combined into books. A gifted writer, Shaler could write a charming book for the young student (e.g. his First Book in Geology, 1885), or a learned article dealing in geological theory. But Shaler was at his best in the popularization of geology. His Aspects of the Earth (1889) was an outstanding example and combined geology with warnings on the need of the conservation of resources. Shortly before his death he ranked eighth in order of distinction among living American geologists. He attained this position less through his contributions to geological theory than by his efforts to popularize geology, to emphasize its practical aspects, and by his teaching.

Shaler served as Dean of the Lawrence Scientific School from 1891-1906. As Dean he used modern promotional techniques to increase the School's enrollment, argued against President Eliot and in favor of applied science in Harvard, and fought against Eliot's attempt to merge the School with M. I. T. Through Shaler's influence, Harvard received the Gordon McKay endowment, the largest it has ever received.

Shaler enjoyed great popularity as a teacher and as a writer on education. He was a follower of Herbert Spencer and advocated greater student freedom, the need of athletics, and gave a qualified approval of the elective system.

Shaler's "myriad-minded character," as William James described it, revealed itself in the diversity of his writings. A racist, Shaler believed in Negro inferiority, expressed concern over the increasing numbers of southern and eastern European immigrants, and joined the Immigration Restriction League. As a scientist he found "scientific" support for his position.

His varied interests included the field of history. Drawing upon his geographical knowledge, he developed a systematic geographical interpretation of history (e.g. Nature and Man in America, 1891) and made particular contributions in the application of soil and landforms as geographic factors in American history. He was the leading exponent of the geographical interpretation of American history at the close of the nineteenth century. His historical writing also included Kentucky: A Pioneer Commonwealth (1884), and a work which he edited and contributed to, The United States of America, 2 vols. (1894). As attempts of an earth scientist to function as a historian they are contributions to American historiography and particularly reveal the acceptance of the idea of progress.
371 pages. $4.75. Mic 57-2999

HEREDITARY SPHEROCYTOSIS IN PEROMYSCUS MANICULATUS

(Publication No. 20,202)

Ruth Suzanne Anderson, Ph.D.
University of Oregon, 1957

Adviser: R. R. Huestis

The syndrome of hereditary spherocytosis in Peromyscus maniculatus has been investigated. Survival studies of red cells from mutant animals showed that the basic genetic defect is intrinsic to the erythrocyte. Red cells from affected animals, labeled with radioactive chromium, had a shortened survival time when transfused into either normal or affected recipients. The survival time of red cells from normal mice transfused into affected recipients was normal.

The abnormal red cells are characterized by their spherocytic shape, which is due to increased thickness relative to their diameter and is not associated with an abnormal cell volume. Concomittant with the consistent finding of spherocytosis in blood of affected animals was a marked increase in the osmotic fragility of the erythrocytes. The osmotic fragility tests and other observations indicated that the normal allele is not always completely dominant to the mutant gene.

The relatively rapid rate of erythrocyte destruction in mutant mice does not usually result in anemia. Hyperactivity of the bone marrow in affected animals is indicated by the elevated reticulocyte percentage in the peripheral blood and normoblastic hyperplasia of the bone marrow. It is probable that anemia occurs only in the cases in which erythrocyte destruction is so rapid that the compensatory capacity of the bone marrow is exceeded.

The spleen appears to be the site of the abnormally high rate of red cell destruction in the mutant animals. Erythrocytes from affected animals survived for a normal length of time when transfused into splenectomized recipients. The percentage of reticulocytes in the peripheral blood of mutant mice was decreased following splenectomy.

In mutant animals birth is followed by a period of very active hemolytic activity. This period is correlated with the beginning of a process of splenic hypertrophy which continues into adulthood. The period of active hemolysis is succeeded by a period of anemia which is presumably due to a temporary inability of the erythropoietic tissues to produce red cells as rapidly as they are being destroyed. Indications of very active erythropoiesis, present in both normal and mutant animals at birth, persist for a longer time in the mutants. During this time, the animals recover from the anemia.

The syndrome of hereditary spherocytosis in Peromyscus appears to be basically similar to that of the same disease in man. 105 pages. $2.00. Mic 57-3000

PHYSICAL AND BIOLOGICAL COMPARISON OF THE RADIATION PROPERTIES OF Fe^{55} AND Fe^{59}

(Publication No. 21,031)

Arthur Cole, Ph.D.
The University of Texas, 1957

Supervisor: Dr. W. K. Sinclair

A study of the Relative Biological Effectiveness (RBE) of low energy radiation of Fe^{55} (5 Kev average energy, 6.6 Kev per micron average linear energy transfer) compared with the beta particle radiation of Fe^{59} (120 Kev average energy, 0.63 Kev per micron average linear energy transfer) was performed, using survival of Streptomyces griseus spores suspended in solutions of these isotopes as a test system. A comparison with 200 KevP X-rays was also made. Quantitative study of the dose-survival characteristics indicates the relative effectiveness of Fe^{55} radiation compared with Fe^{59} radiation (RBE Fe^{55}/Fe^{59}) is 1.07 ± 0.24. This RBE dependence is compared with that expected from several simple models of interaction systems.

A study of this type requires that the energy expended within the spore be defined. This energy is dependent upon the average energy per disintegration, the number of disintegrations, and the distribution of radiation activity. Physical analyses and procedures were utilized to determine these factors. The measurement of the disintegration rates was accomplished by depositing Fe^{55} or Fe^{59} on 0.1 micron thick foils and counting in a 4π Geiger counter. The accuracy of sample standardizations using this technique was $\pm$ 5% for Fe^{55} and $\pm$ 3% for Fe^{59}. Comparative standardizations used in the work were accurate to $\pm$ 15% for Fe^{55} and $\pm$ 5% for Fe^{59}.

Standardization of Fe^{55} requires a measurement of both K X-rays and Auger electrons emitted. The K X-rays alone may be used for standardization if the fraction, ω_K of the total disintegrations leading to K X-ray emission is known. Reported ω_K's vary $\pm$ 15% for the elements adjacent to Mn - the radioactive atom resulting from Fe^{55} electron capture. No value for Mn has been reported. An independent determination using the 4π counter first as an electron detector and then as an X-ray detector indicated $\omega_K = 0.29 \pm 0.015$ for Mn in agreement with the interpolated value for the average of measurements reported for adjacent elements.

Solutions of the two isotopes, complexed with Perma Kleer chelating agents (structure unpublished but believed to be EDTA derivatives), sufficient to produce a dose rate of about 1400 rads per day (1 rad = 100 ergs per gm), were innoculated with concentrated spore suspensions. Control solutions of comparable chemical but nonradioactive environments were similarly innoculated. Spores in the concentrated Fe solutions would survive only if the Fe

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were tightly complexed into a chelate structure and stored at 4° C., the survival then being comparable to that in 0.85% saline solutions at 4° C.

Survival, based upon macroscopic colony formation of withdrawn samples, in the two radioactive solutions, relative to the control solutions, was observed as a function of irradiation time (30 days total). The results indicated a 37% survival dose of about 10,000 rads for all radiations, an RBE of 1.07 ± 0.24, a dose-rate independent response, an approximately logarithmic dose-survival characteristic, and a synergistic killing effect of the chemical Fe complex and the radiation.

168 pages. $2.20. Mic 57-3001

SOME EFFECTS OF "UNCOUPLING AGENTS" ON PLANT TISSUES AND MITOCHONDRIA

(Publication No. 22,254)

Bhagwan Krishan Gaur, Ph.D.
Purdue University, 1957

Major Professor: Dr. Harry Beevers

Assuming that there was some common process through which uncoupling agents act on respiration, it appeared to be interesting to study what structural requirement should be most effective to bring about their action. Secondly, it was hoped that differences in responses of tissues of different ages might provide evidence to clarify the mechanism of DNP* action. To examine these two questions, a number of compounds like phenol, mononitro- and monohalophenols, dinitro- and dichlorophenols, sodium azide and methylene blue were tested for their effects on oxygen and sugar uptakes by carrot discs and on oxygen uptake by castor bean endosperm mitochondria.

Phenol was found to be the weakest compound as uncoupling agent in carrot discs. Any kind of substitution, whether halogenation or nitration, enabled it to stimulate respiration more effectively. Among mononitrophenols, para substituion gave greatest stimulation (142% over controls) with ortho being lowest and meta, intermediate. The molar concentrations giving 50% inhibition of oxygen uptake were in the following order: o->m->p->dinitro. The results broadly apply to mitochondrial oxidation also.

Among halophenols again, para substitution with chlorine was the best one and as good as the NO_2 substitution. Though ortho was more stimulatory than meta, yet on a molar concentration basis, the relationship was similar to that in NO_2 substitution. Dichlorophenol was almost as effective as p-chlorophenol. These findings were qualitatively similar to the results with mitochondrial experiments. Bromophenols, tested only on carrot discs did not exhibit any definite trend with change in substitution.

The ability of various phenols to inhibit respiration has been evaluated by comparing their "DNP indices".

Sodium azide induced a little increase in oxygen uptake in mitochondria but none at all in carrot discs. Methylene blue has a weak respiration stimulatory activity for both carrot discs and castor bean mitochondria.

In general, most of the uncoupling agents tested were stronger respiratory stimulants (i.e. better uncouplers) in carrot discs than in mitochondria. Most of these compounds induced maximum stimulation in mitochondria at 50-200 times the concentration needed in carrot discs, and DNP required a 1000 times increase.

To correlate the respiratory increases with the changes in the ability of tissues to do constructive work, simultaneous measurements of oxygen and sugar uptakes were made with carrot tissues. Each compound was tested only at three concentrations i.e. slightly stimulatory, most stimulatory and inhibitory concentrations. The sugar uptake was reduced at all levels of the uncouplers. Also, the per cent inhibition of sugar uptake was greater than that of oxygen uptake in inhibitory concentrations.

In bringing about 50% inhibition of sugar uptake, para-substitution was most effective, meta and ortho coming next in order. DNP was the strongest inhibitor of sugar uptake and at the same time gave highest increase in respiration.

Sodium azide was found to inhibit both respiration and sugar uptake, the latter being inhibited more strongly than the former, methylene blue gave stimulations of both respiration and $C^{14}O_2$ evolution but not of sugar uptake.

Experiments on the relationship between metabolic activity and DNP action showed that in carrots, the initial respiration rate decreased as the tissue ages, but the per cent stimulation due to DNP increases at the same time. The actual maximum oxygen uptake in the series treated with optimum DNP concentration is nearly the same at all ages. The average diameter of the carrot was found to be inversely related to initial respiration rate, so it was used as the criterion of age.

Using different parts of castor bean hypocotyl, which showed different respiratory rates, a similar qualitative relationship was found between metabolic activity and DNP action as in carrots.

Following broad conclusions were derived:

1. All the substituted phenols tested in this work, show typical uncoupling effects and can be, therefore, regarded as uncouplers like the classical dinitrophenol.
2. The effectiveness of uncoupling action appears to follow a definite structural configuration regarding the position of substitution group in the phenolic nucleus. The order of activity is: para>meta>ortho.
3. All of the uncoupling agents tested can inhibit an endergonic process like sugar uptake, even at levels which are markedly stimulatory to respiration.
4. The poor uncoupling ability of DNP at higher initial respiration rates is suggestive of the uncoupler acting through its effect on the ADP, ATP balance which controls respiration rate.
5. Sodium azide and methylene blue do not appear to behave the same way as other uncoupling agents.

142 pages. $2.00. Mic 57-3002

*DNP represents 2,4-dinitrophenol.

STUDIES ON THE METHODS OF PRODUCTION AND THEORETICAL APPLICATIONS OF LARGE RINGS OF CHROMOSOMES IN MAIZE

(Publication No. 22,459)

Lawrence Lloyd Inman, Ph.D.
University of Minnesota, 1957

Adviser: C. R. Burnham

There are a number of possible uses for multiple translocation stocks in practical breeding and other studies. One of these, a proposed method for the production of homozygous lines, requires a multiple translocation stock that will produce progeny with a ring of all the chromosomes when crossed with a stock with a normal arrangement of chromosomes.

Multiple translocation stocks that produce progeny with a ring of six chromosomes were obtained in the progeny of crosses between two translocations that involved one chromosome in common. They result from crossing over in the differential segment (the section between the two translocation breakpoints) in the common chromosome. One method of identifying them was by the high pollen sterility of plants from the F_1's crossed with plants with a normal arrangement of chromosomes. The presence of the rings of six was verified by cytological examination of the pollen mother cells.

Another method that was tried was the use of test crosses with selected plants. Several variations of these methods are described. Included are methods for the use of genetic markers that are closely linked to the breakpoints in the two chromosomes that are not common to the two translocations. Each marker gene is introduced, not into the stock which has a translocation for the chromosome on which the marker gene is located, but into the translocation stock in which that chromosome is normal. Recombinations between the two markers should in most cases be crossovers in the differential segment.

A multiple translocation stock that produces a ring of eight chromosomes was obtained in a normal test cross of the F_1 between two "ring of six" multiple translocation stocks that had one translocation in common. The F_1 of this cross (2-3d+2-4b) X (2-4b+4-8a) had two rings of four chromosomes. As shown by cytological examination of this F_1 crossed with a normal stock, the progeny included plants with a ring of eight, a ring of six, or a ring of four chromosomes. Theoretically, by an extension of this technique, component multiple translocation stocks could be combined to produce a ring including the entire chromosome complement, at the same time avoiding any sterility higher than the 75% expected from two rings of four.

In a species with an even haploid number of chromosomes it was demonstrated by diagrams that progeny with two rings of chromosomes are to be expected from a cross between a stock with a normal arrangement of chromosomes and a homozygous multiple translocation stock having a translocation on every arm of every chromosome of the complement. Also, the homolog of each differential segment is in the other ring making the rings interdependent. It is suggested that interdependent rings may be of interest for studies of chromosome pairing. In such a species, a multiple translocation stock with a translocation in all arms but one will produce a ring including all the chromosomes. In a species with an odd haploid number, a stock with a translocation on every arm will produce a ring with all the chromosomes.

A proposal is outlined for the production of chromosome "substitution" lines by the use of large rings of chromosomes, e.g. the substitution of one chromosome from inbred A into inbred B. 74 pages. $2.00. Mic 57-3003

MEASUREMENT OF THE CYTOPATHOGENIC EFFECT OF POLIOMYELITIS IN MONKEY KIDNEY ROLLER TUBE CULTURES

(Publication No. 22,052)

René Jahiel, Ph.D.
Columbia University, 1957

The cytopathogenic effect of a poliomyelitis virus (Wisconsin strain) in monkey kidney roller tube cultures was recorded by counting the number of cells showing lesions in the outgrowth. The results showed a stepwise increase in the number of lesions with time following inoculation, with at least two well defined cycles of lesions. The distribution of the lesions in the outgrowth was random during the first 11 hours and partly focal thereafter. The latent period for the first cycle of lesions, the ratio of the number of cell lesions developing during the first cycle to the infective titer of the inoculum, the latent period for the second cycle of lesions and the ratio of the number of foci developing during the second cycle to the infective titer of the inoculum were, within defined experimental conditions, independent of the infectious titer of the inoculum. The interpretation, limitations and possible applications of these measurements are discussed.

40 pages. $2.00. Mic 57-3004

SEED DEVELOPMENT FOLLOWING HYBRIDIZATION BETWEEN DIPLOID SOLANUM SPECIES FROM MEXICO, CENTRAL AND SOUTH AMERICA

(Publication No. 22,381)

John Himyung Lee, Ph.D.
The University of Wisconsin, 1957

Supervisors: Professor Delmer C. Cooper
Associate Professor Robert W. Hougas

Many of the diploid Solanum species are known to possess desirable economic characters such as resistance to disease, especially to late blight, X and Y viruses. Incorporation of such characteristics into the commercial potato, S. tuberosum is highly desirable. Such incorporation calls for an extensive interspecific hybridization program. The ability of the parents to produce viable seed is one of the first requirements in plant breeding. This requirement is often difficult to meet where interspecific matings are involved.

A knowledge of seed development and the course of seed failure following interspecific crosses may shed some light in regard to methods of overcoming difficulties of hybridization. Therefore, the establishment of the

degree of embryo development becomes necessary. In an attempt to determine the cause and nature of the incompatibility following interspecific crosses, a study of the seed development in Solanum pinnatisectum following self pollination, and of seed failure following hybridization between this species and S. chacoense, S. goniocalyx, S. kesselbrenneri, S. macolae, S. simplicifolium and S. yabari was undertaken.

Fertilization takes place between twenty-four and forty-eight hours after S. pinnatisectum is self pollinated. The division of the zygote occurs at five days after pollination. The endosperm differentiates into a composite structure consisting of a pheripheral region with small, densely cytoplasmic cells and an inner region with large, highly vacuolate cells. The integumentary cells immediately adjacent to the endothelium are in a process of disintegration. The endothelial cells collapse as the endosperm increases in volume. The endosperm is in turn broken down during the course of development of the cotyledons of the embryo. The cotyledons are initiated at sixteen days after pollination. Well-developed cotyledons are present at the twenty-day interval, and the associated endosperm is being dissipated.

Abundant fruit production results following the crosses, S. pinnatisectum x S. chacoense, x S. goniocalyx, x S. kesselbrenneri and x S. yabari. No viable seed has been obtained following these crosses. Fertilization takes place in a majority of ovules, the seeds initiate development and then collapse. The rate of endosperm cell division is slower than occurs in the controls. A lack of the endosperm differentiation becomes apparent at five days after pollination. The cells of the endosperm remain small and no vacuolation occurs. They become increasingly collapsed and ultimately disintegrate as development of the embryo advances. The endothelial cells enlarge and sometimes proliferate until they completely replace the collapsing endosperm. The embryos continue to develop in an apparently normal manner until approximately fifteen days after pollination. They are in a many-celled stage at this interval. Shortly thereafter the cells of the embryos break apart and collapse. No endosperm cells are extant at this interval.

No fertilization takes place following the crosses S. pinnatisectum x S. macolae and x S. simplicifolium. Samples of pollen grains from both paternal parents manifest a stainability of fifty to seventy per cent with aceto-carmine. The failure of the crosses can not be attributed to pollen sterility.

The evidences from the present investigation support the view that in the Solanaceae the nutrition of the developing seed depends on successive digestion of the integumentary cells by the endosperm and of the endosperm by the growing embryo. Seed failure following the interspecific crosses is the result of a failure of the endosperm to differentiate properly so that it can function as a nutrient medium for the developing embryo. The resulting disruption of the nutritional balance within the seed leads to degeneration of the endosperm and hyperplasia of the adjacent maternal tissue. Ultimately the seed collapses due to starvation of the embryo.

38 pages. $2.00. Mic 57-3005

THE DEVELOPMENT, CYTOLOGY AND SEXUALITY OF SYNCHYTRIUM BROWNII KARLING

(Publication No. 22,273)

Banadakoppa Thimmappa Lingappa, Ph.D.
Purdue University, 1957

Major Professor: Dr. J. S. Karling

Synchytrium brownii is a long-cycled species which produces repeating haploid generations of prosori, sori and sporangia, and diploid resting spores in the living plants of Oenothera biennis. The former phase propagates the fungus rapidly and the latter perpetuates it through adverse conditions.

The planospores are sexually neutral in the beginning and form clumps, clusters and pairs. Some of them ultimately differentiate into two types of gametes, a receptive one which becomes sedentary and aflagellate, and a searching flagellate type which remains active for longer time. Copulation occurs between gametes of these two types. As far as is known, neither alteration of the sex of the gametes, nor relative sexuality occurs in S. brownii. Plasmogamy is soon followed by karyogamy. The zygote is non-motile, spherical and has a single flagellum for a brief period. The oily globules also fuse in the zygotes. The planospores which do not differentiate into gametes function as zoospores.

The zoospores as well as the zygotes attach themselves firmly to the host surface, and their content flows into the epidermal cells of the host leaving their membranes and oil globules on the host surface. The thalli derived from the zoospores give rise to evanescent prosori which mature in about 8 days at 27°C.

A remarkable evanescent cytoplasmic organoid develops in the cytoplasm of the mature prosorus. With the full development of this organoid the primary nucleus is displaced to the base of the evanescent prosorus. Soon after, the content of the prosorus begins to flow out to form a vesicular incipient sorus, and the primary nucleus enters into early prophase during migration. Then the primary nucleus becomes outstretched into a crescent-shaped densely granular zone with a narrow cavity. A well-defined spindle is developed with five chromosomes. At this stage a distinct, intact nuclear membrane is not visible. After several successive divisions of the secondary nuclei, the incipient sorus cleaves into several multinucleate segments which are the incipient sporangia. In each of them repeated mitotic divisions occur and give rise to numerous ultimate nuclei each of which is later contained in a planospore.

The zygotic thalli develop into resting spores in about 12 days at 27°C. They function as prosori in germination and give rise to spherical, vesicular incipient sori. Therefore, they are regarded as resting prosori in contrast to the evanescent prosori. In the vesicle the primary nucleus apparently divides meiotically but meiosis has not been observed. Repeated mitotic divisions of the secondary nuclei, cleavage and, further development and maturation of the sporangiosori are similar to those derived from the prosori. The resting spores begin to germinate within 15 days when kept wet at 20-27°C. Germination under such conditions may continue sporadically for three years. They germinate one month to three years after maturation.

Evanescent prosori and incipient sori can withstand sub-zero temperatures within the living host cells. Resting spores and to some extent the sporangia can do so outside the living host cells also. Consequently, both propagating and perpetuating generations can over-winter. Whereas the evanescent prosori mature in about a week at 30°C., they take 120 days or more to mature while growing under severe winter conditions at Lafayette, Indiana.

When placed in fresh water sporogenesis in ripe sporangia, whether derived from the evanescent prosori or resting spores, takes place within 10 minutes to 3 hours at 20-27°C. The planospores from both of them are similar in appearance and behaviour. Sporogenesis in the ripe sporangia can take place at 3-30°C., but below 10°C. 10 hours or more are required for sporogenesis and emergence of the planospores. One hour exposure to 35°C. kills the sporangia, and 60°C. kills the resting spores.

129 pages. $2.00. Mic 57-3006

SELECTION FOR COMBINING ABILITY IN A MALE-STERILE TOMATO LINE HAVING TWO RECESSIVE SEEDLING GENES

(Publication No. 22,471)

Richard Lincoln Nickeson, Ph.D.
University of Minnesota, 1957

A program of testing, selecting, and inbreeding with the tomato was carried out in the F_3 and F_4 generations of the cross NC-1-48 x Firesteel. The object was to identify a plant and develop a line carrying the recessive genes for functional sterility, green stem, and potato leaf that would be equal to Firesteel in general combining ability for earliness, yield, and fruit size.

Eight (NC-1-48 x Firesteel) F_3 plants (psps cc aa) and the parents were selfed and also crossed with two tester varieties, Break O'Day and Penn Orange. These 20 crosses in addition to the testers and Firesteel were grown in randomized replicated block design in 1953, and compared for early growth, early, total, and marketable yield, and for fruit size.

General combining ability results for early growth (the number of degree days required from transplanting to fruit ripening) showed F_3 plants 1 and 4 to be significantly lower in degree day requirements (earlier) than Firesteel. Degree days represent the cumulative degrees per hour above a base of 59° F., divided by 24.

In combining ability for early yield, F_3 plant 1, 4, 5, and 6 were definitely superior to Firesteel, and plant 4 was definitely superior to its sibs. F_3 plants 1 and 4 were the highest general combiners for total yield, being significantly better than Firesteel and all sister plants but 5, 6, and 8. For marketable yield the differences were smaller; F_3 plants 1 and 4 again were highest, but only significant when compared to plants 2 and 3.

Firesteel was the best in general combining ability for fruit size and produced significantly larger fruit than all F_3 plants except 2, 4, and 5.

Because of its high general combining ability for all characters and its superiority to Firesteel for two characters, plant 4 was selected for further inbreeding, testing, and selection.

Ten F_4 plants obtained by hand selfing F_3 plant 4, NC-1-48 S_2, and Firesteel, were crossed with two F_1 hybrid testers, Early Chatham x Jubilee and Penn Orange x Bounty. Crosses of Firesteel with the former matured late, thus the comparisons with Firesteel, except for fruit size, were limited to the latter cross. Evaluations for combining ability were based on the measurements of progeny performance used the previous year.

In general combining ability for degree days required to complete early growth, F_4 plant 9 was significantly lower than its sibs. In specific combining ability with Penn Orange x Bounty, plant 9 was definitely lower than Firesteel.

Plants 5, 3, and 4 were highest in general combining ability for early yield, but only the first two showed a significant difference compared with the lowest yielding plants. There were no real differences among the F_4 plants and Firesteel crossed with Penn Orange x Bounty. For total yield, plant 10 was significantly better than all F_4 plants but 4, 8, and 9. There were no significant differences among the F_4 plants and Firesteel when crossed with Penn Orange x Bounty. Plant 10 was again highest in combination with both testers for marketable yield with the significant comparisons the same as those cited for total yield.

No significant differences occurred among the general combining ability means for fruit size, although those of plants 8, 3, and 4 were largest.

Although no single F_4 plant was outstanding for all characters, plant 4 was generally good and ranked high for early yield in combination with Penn Orange x Bounty. Therefore, it was selected and self-pollinated. Selecting a single plant at random and selfing was continued for two more generations. Although further tests must be made, it is expected that this F_7 line is now reasonably homozygous and could be used to replace Firesteel in producing F_1 hybrids.

132 pages. $2.00. Mic 57-3007

THE CHROMOSOMAL PATTERNS OF SOME OPILIONIDS (ARACHNIDA)

(Publication No. 22,285)

Mandyam Dhati Parthasarathy, Ph.D.
Purdue University, 1957

Major Professor: Clarence J. Goodnight

The relationships of animals to one another is usually studied by observing external characters. Recent studies, however, have shown that relationships also can be demonstrated by chromosomal patterns. These patterns can best be studied by examining the developing spermatogonia in the male testes.

For this study, members of the arachnid order Opiliones were used. The opilionids are the familiar daddy-long-legs or harvestmen which become abundant in the fall of the year. The long-legged forms are members of the family Phalangiidae, and they have been studied in this manner by various European and Japanese workers. Early workers confined their studies to the structure of the spermatozoön, but more recently, workers have studied the chromosomal patterns. The chromosomal number for

several forms has been established, but none of these workers has been able to demonstrate a sex chromosome.

In this study, three species of the genus Leiobunum (L. crassipalpe, L. nigripes, and L. ventricosum) of the family Phalangiidae were studied. All three had a diploid number of 22, and no sex chromosome was observable.

Vonones ornata, a member of the family Cosmetidae, was also studied. This family is confined to the New World, and is chiefly found in tropical and subtropical areas. A few species can be found in sections of Indiana. Careful examination of the developing sperms in V. ornata clearly demonstrated that there were 25 chromosomes in the diploid condition, and 13 or 12 in the haploid. The extra chromosome can definitely be considered the sex chromosome due to its behavior during meiosis. It could be seen as an odd chromosome without an apparent homologue in the spermatogonia or in the metaphase plate of the primary spermatocyte. Its location on the plate and its precession were also indicative of its role. The X-element is pre-reductional without division, exhibits heteropycnosis and precession which are characteristic of sex chromosomes. Thus the sex chromosome mechanism of V. ornata is of the X-O type.

The opilionids thus represent an approximate middle position between scorpions and false scorpions and the mites in respect to their chromosome number. The scorpions have a very high number and the mites have a very low one. The demonstration of the X-O type of sex determination in the cosmetids may help to fit the opilionids in with the other arachnid groups. Formerly, their sex mechanism was not understood.

75 pages. $2.00. Mic 57-3008

ANTIGENIC PROPERTIES OF BACTERIAL FLAGELLA

(Publication No. 22,289)

Kurvenal Stanley Read, Ph.D.
Purdue University, 1957

Major Professors: Henry Koffler and Merwin Moskowitz

Although the antigenicity of bacterial flagella has been the subject of many investigations, only one study so far has dealt with isolated and purified flagella. The present investigation considers the antigenic properties of flagella isolated from Proteus vulgaris as studied by the quantitative precipitin reaction.

Flagella were shaken from P. vulgaris, and were purified by differential centrifugation. The purified flagella contained less than 0.01% hexose and 0.001% pentose. Observation with the electron microscope showed that preparations of purified flagella appeared like flagella still attached to cells, except that smaller pieces were present, probably as a result of breakage during the shaking and purification procedures. No non-flagellar material was observed.

Saline suspensions of flagella were subjected to acid (pH 2.5, 25° C, 10 minutes) and heat (60° C, 30 minutes). Both treatments markedly decreased the viscosities of the suspensions. Both suspensions were centrifuged at a gravitational force (25,000 x G, 3 hours, 0° C) sufficient to remove normal flagella and no centrifugate formed. This, plus the absence of any flagella visible with the electron microscope, indicated that the acid and heat treatments resulted in the "disintegration" of the flagella.

Sera against normal flagella, acid-treated flagella, and heat-treated flagella were prepared in rabbits.

The precipitin reaction obtained with normal flagella in serum against normal flagella was not typical of that obtained with soluble protein-antiprotein systems. When high concentrations of flagella were added to antiserum, the reaction mixtures formed a gel. The gels formed so rapidly that it was difficult to secure thorough mixing of the reactants. Lack of thorough mixing may have resulted in antibodies remaining uncombined because of steric hindrance in the precipitates. After removal of the precipitates by centrifugation, the supernatant fluids precipitated more flagella when tested for excess antibody.

The antibody-antigen nitrogen ratio was 1.1 in the first reaction mixture where maximum antibody precipitation was reached. Other workers have found similar ratios with other macromolecular antigen-antiserum systems.

When acid-treated flagella and heat-treated flagella were reacted with serum against normal flagella, both types of treated flagella combined with only 20% of the antibody nitrogen that the serum contained against normal flagella. Equivalence was not obtained in either of these reactions. Inhibition of precipitation occurred in both reactions in the regions of antigen excess.

Acid-treated flagella were reacted with serum against them and a precipitin curve was obtained with regions of antibody excess, equivalence, and antigen excess. The antibody-antigen nitrogen ratio at equivalence was 12.7.

Heat-treated flagella were reacted with serum against them. Equivalence did not occur in any of the chosen concentrations of antigen and antiserum, but the precipitin curve was similar in general form to that of the acid-treated flagella-antiserum system.

The reaction of normal flagella in serum against heat-treated flagella, like the reaction of normal flagella in serum against normal flagella, was characterized by gel formation. The combining ratios of these two reactions at the point of maximum antibody precipitation were approximately 1. Normal flagella and heat-treated flagella both combined with the same amount of antibody nitrogen in serum against heat-treated flagella.

Normal flagella, acid-treated flagella, and heat-treated flagella were reacted with serum against normal flagella using the Ouchterlony agar diffusion technique. A single zone was formed between each antigen reservoir and the antiserum reservoir. The zones from the two types of treated flagella were identical in shape, density, and location. The zone from the normal flagella was shorter and more diffuse. 61 pages. $2.00. Mic 57-3009

FERTILITY IN RELATION TO CHROMOSOME BEHAVIOR IN BROMUS INERMIS LEYSS.

(Publication No. 22,210)

Keith Francis Schertz, Ph.D.
Cornell University, 1957

Open-pollinated fertility, heritability of fertility and chromosomal behavior in relation to variation in fertility were investigated in selected clones of Bromus inermis.

There was a range of 1.2 to 75.4 percent and a mean of 46.8 percent fertile florets among the 60 clones.

Progenies resulting from open-pollination of 3 clones by different groups of pollen parents which varied in open-pollinated fertility showed significant differences for percentage fertile florets between progenies and between plants within progenies.

For 25 clones the numbers of chromosomes were determined by root-tip smears by means of 8-Hydroxyquinoline pretreatment and enzyme digestion. There were 3 clones with 54 regular chromosomes, 8 with 55, 12 with 56, 1 with 57 and 1 with 58. Fragment chromosomes were found in cells of 4 of the 25 clones and in cells of 3 additional clones for which exact chromosome numbers were not determined.

Euploids were found to be more regular at meiosis and slightly higher in fertility than aneuploids. Clones without fragment chromosomes were found to be more regular at meiosis and slightly higher in fertility than clones with them.

Meiotic irregularities were noted in all clones studied. Detailed observations were made of the frequencies of anaphase I lagging univalents and spore quartet micronuclei.

The mean for the 60 clones was 0.91 for laggards per anaphase I cell and 50.3 percent for anaphase I cells with laggards. Each of these characteristics was negatively correlated at a significant level with percentage fertile florets. The mean for the 60 clones was 0.94 for micronuclei per spore quartet and 43.6 percent for spore quartets with micronuclei. The latter characteristic was negatively correlated at a significant level with percentage fertile florets.

Percentage stainable pollen did not show a significant relationship with percentage fertile florets, frequencies of meiotic irregularities or chromosome number.

The observations of fragment chromosomes made in root-tip sections, root-tip smears and sporocyte smears were in conformity with each other and the chromosome number determinations made by root-tip smears and sporocyte smears were identical.

135 pages. $2.00. Mic 57-3010

IMMUNOLOGICAL CHARACTERIZATION OF Vi ANTIGENS

(Publication No. 21,552)

Roberta Emerson Whiteside, Ph.D.
Boston University Graduate School, 1957

Major Professor: Professor Edgar E. Baker

Vi antigen was first discovered as a component of the typhoid bacillus in 1934. Since that time, serologically identical or very closely related Vi antigens have been found to occur in almost all freshly isolated strains of Salmonella typhosa, in some strains of Salmonella paratyphi C and in one strain each of Paracolobactrum ballerup and Escherichia coli. The purpose of the present investigation was to immunologically characterize Vi antigens which were purified by the method of Baker (Baker, E. E., To be published).

Serologic properties of Vi antigens were studied by the agar diffusion technique. It was found that zones of specific precipitate could be identified in the agar which were due to Vi antigen and its antibody. Vi antigens prepared from P. ballerup, E. coli, S. typhosa, strain Ty2 and S. typhosa, strain 61 were serologically identical by this method.

This precipitin technique presented itself as a highly sensitive method for detection of small amounts of antigens and as little as 1.0 microgram of purified Vi antigen per milliliter of 0.15 M sodium chloride solution formed a visible zone of precipitation. In order to be certain that the properties of Vi antigen under consideration were attributed solely to Vi antigen, this sensitive agar diffusion technique was applied to determine purity of antigen preparations. It was noted that Vi antigens derived from P. ballerup and S. typhosa, strain 61 were serologically pure substances. However, Vi antigen preparations were isolated from E. coli and S. typhosa, strain Ty2 which contained a very small amount of another substance.

A serologic study of Vi antigen was made in which several concentrations of Vi antigens were reacted in agar diffusion precipitin tests with different dilutions of antisera. The antisera were prepared by immunizing rabbits with acetone killed and dried organisms containing Vi antigen. It was observed that at a certain ratio of Vi antigen to antibody, two precipitate zones were visible. Since the position of the precipitate zone in the agar was determined by the concentration of reactants when other factors remained constant, one antibody concentration was reacted with decreasing concentrations of Vi antigen. The two zones of specific precipitate became superimposed and further dilution of Vi antigen did not result in separation of the two zones. It may be that acetylated and a small amount of deacetylated Vi antigen were present in the purified preparations. Like the capsular polysaccharide of Pneumococcus Type I, acetylated Vi antigen may be capable of absorbing all the specific antibody while the deacetylated antigen may have been capable of absorbing only antibody reactive with the deacetylated antigen leaving the antibody titer for the acetylated antigen unchanged. This hypothesis was strengthened by agar diffusion precipitin studies using Vi antigen which was deacetylated by hydrolysis with sodium hydroxide.

Vi antigens were characterized further biologically. Acetone killed and dried Vi containing organisms were excellent immunizing agents in the rabbit. However, purified Vi antigens from these organisms were very poor immunizing agents in rabbits.

Rabbits were apparently very sensitive to intoxication by the Vi containing organisms under study. Therefore, purified Vi antigens were tested for toxic effects in these animals. It was found that the pure Vi antigens were relatively non-toxic even when administered in large doses.

Purified Vi antigens were employed as preparatory injections in an effort to demonstrate the Shwartzman phenomenon of local skin reactivity. It has been shown that pure Vi antigens were incapable of preparing rabbit skin for the local Shwartzman reaction.

The agar diffusion technique was employed in comparative studies of antigens from several strains of S. typhosa. Antigenic analyses of the various strains of S. typhosa are still under investigation.

A technique of absorption directly in the agar diffusion plate was proposed and is presently under study.

113 pages. $2.00. Mic 57-3011

TAXONOMIC STUDIES OF THE TREMELLACEAE

(Publication No. 22,070)

Robert J. Bandoni, Ph.D.
State University of Iowa, 1957

Chairman: Professor G. W. Martin

The study includes a brief history of the classification of the family Tremellaceae. Generic names which have been proposed in the group are listed and discussed and a key to the accepted genera is provided. The morphology of several subtypes of the tremellaceous basidium is described.

The greater part of the study is devoted to a taxonomic survey of the type genus, Tremella. This consists of an annotated list of 248 names which have been used since the official starting point for the nomenclature of the genus. Descriptions, based on studies of the type specimens, are provided for a number of little known tropical species. Descriptions prepared from specimens or derived from the literature are given for the common temperate species. A number of forms were found to belong to other genera and families and some names were reduced to synonymy. Illustrations are provided for 29 species.

The nature of the basidium and spores of the genus Sirobasidium is discussed. The genus was found to have deciduous epibasidia which produced typical basidiospores after falling from the basidium. This would appear to indicate a close relationship with the Tulasnellaceae and the suggestion is made that a Sirobasidium-like ancestral form may have given rise to both tremellaceous and tulasnellaceous forms. 214 pages. $2.80. Mic 57-3012

SEPARATION AND IDENTIFICATION OF VIRUSES THAT INCITE DISEASES OF STONE FRUITS

(Publication No. 22,337)

Clifford Gerhard Ehlers, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor J. D. Moore

In 1939, Keitt and Clayton demonstrated the virus nature of sour cherry yellows, which is considered a major threat to sour cherry production throughout much of the sour cherry producing area of North America.

In early transmission studies with nursery trees, Moore observed that healthy sour cherry trees inoculated with buds from yellows trees would invariably first express symptoms unlike those attributed to yellows. These symptoms are now recognized as diagnostic for necrotic ring spot, another naturally occurring virus disease of sour cherry. Whereas necrotic ring spot occurs alone, no source of yellows free of necrotic ring spot has been located.

Since the original announcement of a dwarfing disease of Italian prune additional information has linked the virus concerned with the sour cherry complex. All sources of sour cherry yellows studied, with the exception of those in which ring spot is recurrent, induce prune dwarf like symptoms when inoculated to Italian prune. This association has prompted the suggestion that sour cherry yellows is a complex of which necrotic ring spot and prune dwarf viruses are necessary components. The present investigations were undertaken in an attempt to separate the viruses present in this complex so that their effects might be studied separately and in combination.

Dormant bud sticks of Horseshoe Bay 15-7, a source of the necrotic ring spot, the prune dwarf and sour cherry yellows viruses were heat treated in a water bath at (1) 50°C and (2) 35°C. Inoculations made to sour cherry and Italian prune revealed that the sour cherry yellows virus and the necrotic ring spot virus were not inactivated with 35 minutes treatment at 50°C, but were inactivated with approximately 36 hours treatment at 35°C. The prune dwarf virus was inactivated after 22 minutes at 50°C and at 30 hours at 35°C.

The fact that the inactivation of sour cherry yellows and the necrotic ring spot virus seemingly occurred simultaneously would indicate that the necrotic ring spot virus might be a component of the sour cherry yellows complex. It appears that sour cherry yellows virus per se does not dwarf prune.

Symptoms of necrotic ring spot, yellows and prune dwarf failed to develop on Montmorency cherry and Italian prune trees inoculated with buds from dormant bud sticks which had been soaked for 1 hour in certain chemical solutions. Notable of the chemicals were the substitute purine and pyrimidine compounds. It is believed that the failure of necrotic ring spot symptoms to develop was due to an interference by the antimetabolite on virus biosynthesis, since the ring spot virus was recovered later from the sour cherry trees which did not express necrotic ring spot symptoms when inoculated. Additional observations will have to be made before definite conclusions can be made in respect to the sour cherry yellows and the prune dwarf viruses.

Seedlings grown from seeds collected from experimentally infected Italian prune trees were indexed on a stone fruit virus differential herbaceous host range consisting of guar, Sesbania, watermelon and tobacco. Viruses A, B and E were not recovered from any of 302 seedlings studied. Approximately 37 per cent of 302 seedlings indexed induced small necrotic spots on Sesbania. Indications suggest that this reaction is associated with the necrotic ring spot virus. Six guar plants expressed symptoms (Viruses A or G). None of the Italian prune seedlings expressed prune dwarf symptoms.

Inoculum prepared from pollen collected from infected Shiro plum and Montmorency, Dyehouse and Early Richmond

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sour cherries was used to inoculate the differential herbaceous host range. Viruses A, B, E and possibly G were found to be mechanically transmitted from pollen. No virus was recovered from pollen from a virus free Montmorency source. The recovery of Viruses A, B, E and possibly G from a given source indicates that differential transmission through pollen as a means of obtaining separation may not occur. 66 pages. $2.00. Mic 57-3013

A HISTOLOGICAL STUDY OF NORTHERN AND OF SOUTHERN CORN LEAF BLIGHTS

(Publication No. 22,261)

Peter Randolph Jennings, Ph.D.
Purdue University, 1957

Major Professor: Arnold J. Ullstrup

Northern corn leaf blight and southern corn leaf blight, incited by Helminthosporium turcicum Pass. and Cochliobolus heterostrophus Drechsl. (Helminthosporium maydis Nisikado and Miyake) respectively are often serious diseases in many areas of the world where the host is grown. Little is known of the pathogenesis of these diseases. The investigations reported here were designed primarily to obtain some insight into host-parasite relations of the two diseases. A secondary objective was to make a comparative study of the reactions, within each disease, of resistant and of susceptible host tissue from the time of penetration until the development of mature lesions. Knowledge of the pathological histology in resistant and in susceptible hosts is basic to an understanding of the nature of resistance.

Leaves of varying physiological ages were harvested at several intervals following inoculation with spore suspensions. Material for in toto observations was cleared in a 1:1 mixture of absolute alcohol and acetic acid, and then stained with amaline blue in lactophenol. Material for serial sections was fixed in Karpechenke's solution and dehydrated in glycerin followed by 95 per cent alcohol and n-butyl alcohol. Serial sections were cut about 12 μ in thickness and stained in safranin and fast green.

Spore germination and penetration by Helminthosporium turcicum were similar on leaves of susceptible and resistant corn inbred lines. About 90 per cent of all penetrations were direct with the majority occurring from 12 to 24 hours following inoculation.

The fungus became established early in susceptible xylem tissue in which all subsequent growth occurred. Mycelial growth progressively filled vessels and tracheids. Distinct wilt symptoms and chlorenchyma necrosis followed extensive xylem plugging about two weeks following inoculation. Hyphae moved out of xylem into moribund parenchyma only after lesions formed. Symptoms, histological investigations and failure of eosin dye to pass through wilted areas suggested that this blight is fundamentally a localized wilt disease. The absence of pectic plugs in diseased material stained with ruthenium red suggested that mycelial plugging was responsible for the wilting response. The similarity of symptoms and histology of sorghum, sudan grass and broom corn, also susceptible to H. turcicum, suggested that pathogenesis in those plants was the same as in corn.

Resistance to H. turcicum was not evident prior to establishment of hyphae in the xylem. The resistant principle, which probably resides in the xylem appeared not to be a function of morphological structure. Its effect was to inhibit mycelial growth so that wilting and necrosis were greatly delayed, resulting in fewer and smaller lesions.

H. maydis penetrated leaves of susceptible and resistant corn inbreds with equal facility. From 80-85 per cent of all penetrations were direct with the majority occurring from 6 to 12 hours following inoculation.

The fungus, unlike H. turcicum, ramified rapidly through susceptible chlorenchyma. Vascular tissues were not parasitized. Host disturbances and necrosis were closely associated with and were caused by ramifying mycelium. Lateral fungus movement was eventually blocked by large leaf bundles that conferred the parallel-sided appearance to lesions.

Fungus development in resistant chlorenchyma was effectively impeded following penetration. Hyphae, which were confined about the penetration point, elicited only localized host reactions. Chlorenchyma was apparently the site of the unknown resistant principle.

62 pages. $2.00. Mic 57-3014

STUDIES OF PHOSPHORUS AVAILABILITY IN ORGANIC SOILS

(Publication No. 22,270)

John Elbert Larsen, Ph.D.
Purdue University, 1957

Major Professor: G. F. Warren

It has been assumed that extractants employed in measuring the phosphorus status of mineral soils were equally satisfactory for organic soils. Evidence obtained over a number of years indicates that this assumption is incorrect. This work was initiated to determine which of various procedures for extracting phosphorus from organic soils would give the best correlation with plant growth, and to obtain a better understanding of the availability of phosphorus in organic soils.

Three organic soils and one mineral soil were subjected to greenhouse cropping with tomatoes, peppermint, and onions, and to various extractants for measurements of soluble phosphorus. The accuracy of estimation of available phosphorus by the solubility data was obtained by correlating the phosphorus solubility in various extractants with the percentage yields. Seven different extractants, including water, were compared using four different ratios of soil volume to water. The most accurate estimates of plant available phosphorus were found when extractions were made with distilled water using a soil volume to solution ratio of 1:10 for the mineral soil and 1:20 for the organic soils. The threshold value for the point at which yields would not be increased with additional applications of phosphatic fertilizer under greenhouse conditions was established at 10 and 16 pounds per acre of water soluble phosphorus when the soil and water were shaken for 2 minutes and 30 minutes respectively.

The "A" value, which is a measure of the quantity of phosphorus in the soil that is as available to plants as the phosphorus in a fertilizer which has been mixed with the

soil, was calculated from the uptake of P^{32} by tomato and peppermint from $NH_4(H_2P^*O_4)$. The "A" values for six organic soils and one mineral soil were apparently not reliable measures of plant-available phosphorus when compared to the percentage yield.

The retention of fertilizer phosphorus by five organic soils and one mineral soil, when 15 inches of water were leached through soil columns, was closely correlated with the sesquioxide content of the soil and with the apparent degree of decomposition.

When labeled fertilizer phosphorus, was mixed in the surface two inches of a 14-inch column of a virgin organic soil, 60 and 80 percent appeared in the leachate from 15 and 30 inches of water respectively. Lesser amounts of phosphorus appeared in the leachate from soils with greater contents of sesquioxides and with longer drainage histories, while no fertilizer phosphorus was leached from the mineral soil or from the organic soil which had a drainage history of 15 or more years.

The phosphorus fixing capacities of the organic soils were closely correlated with their total sesquioxide contents. An organic soil which had been drained and left under a sod cover for longer than 15 years fixed more than 10 times the amount of phosphorus that was fixed by an equal weight of a virgin organic soil. The iron and/or aluminum additions to either soil greatly increased its phosphorus fixing power even though the iron and aluminum were completely removed from solution before the addition of phosphorus. The addition of humic acid to the organic soil under sod greatly reduced the capacity of the soil to fix phosphorus whether or not additions of iron and/or aluminum had been made.

86 pages. $2.00. Mic 57-3015

PLANT MICROFOSSILS FROM THE BRUHN LIGNITE

(Publication No. 22,668)

Robert E. McLaughlin, Ph.D.
The University of Tennessee, 1957

Major Professor: A. J. Sharp

A study of a Late Cretaceous lignite from West Tennessee has yielded a number of plant microfossils, principally the highly resistant outer coats (exines or sporoderms) of spores and pollen shed during the period of time covered by the formation of the deposit. These microfossils or sporomorphs possess great potential value as stratigraphic tools and provide, at the same time, an insight on the early development of floras in the region.

Fifty of the microfossils were chosen for systematic description and an attempt was made to place them in plant categories recognized by botanists at the present time. It was found that a number of the sporomorphs could be assigned to extant families of plants on the basis of morphological similarity but difficulties were encountered at the generic level. The last was especially true when reference material representing genera suggested by the megafossil identifications of other investigators was compared with the microfossils.

The flora indicated by the microfossils is almost entirely dicotyledonous. Gymnosperms are absent or only faintly suggested. Pollen types characteristic of members of the extant Amentiferae represent the major group present both in numbers and variety. A pollen type similar to that of Castanea dominates all others statistically while several of the types suggest members of the Juglandaceae. Among the latter are two that resemble pollen of the genera Platycarya and Engelhardtia, both with narrowly restricted ranges today in contrast to a wider distribution in the past as shown by the fossil record.

Morphologically peculiar sporomorphs, resembling pollen found in the Myricaceae in certain respects, add to the strangeness of the microfossil assemblage when viewed as a whole. Other investigations of a similar nature have uncovered sporomorphs of this general type in several places.

The number of discrete plant types represented by the microfossils from the Bruhn lignite is a measure of the limited knowledge concerning ancient floras that has been provided heretofore by other kinds of fossil evidence. The need for further investigation is clearly indicated by the results of this study. 192 pages. $2.50. Mic 57-3016

THE FINE STRUCTURE OF THE POLLEN WALL IN THE COMMELINACEAE REICHENB.

(Publication No. 22,473)

John Raymond Rowley, Ph.D.
University of Minnesota, 1957

Adviser: A. Orville Dahl

The primary object of this electron microscope study is the investigation of the physical structure of the microspore and pollen grain walls in a small group of closely related species. The Commelinaceae is a favorable family for a study of this kind. It forms a natural group of plants on the basis of gross morphology, although there are well marked differences between the pollen grains of several genera. The submicroscopic structure of the pollen wall in 18 species in 11 genera of the Commelinaceae was analyzed through the use of ultrathin sections and surface replicas.

Development of the pollen grain in Tradescantia paludosa was employed as a basis for comparative interpretation of wall structures found in the mature pollen of other members of the family.

The basic form of the exine sculpture in T. paludosa is differentiated very early in development. The single dorsal aperture is evident by the fourth day after telophase II. The sculpture of the nonapertural exine is essentially unchanged from the two-day microspore stage to maturity (twelve days). Following the initial differentiation of the exine, areal increase in the pollen grain wall resides predominantly in the endexine between the areolae. Intine is not recognizable until the four to six-day stage. Following the six-day stage the intine increases in thickness more rapidly under the aperture than elsewhere.

The basic elements making up the mature pollen wall in the Commelinaceae are submicroscopically similar in the species examined. The variation in morphology at the microscopic level is due to the individual arrangements of these elements. Sampling of the pollen wall fine structure

in the Commelinaceae indicates a surprising simplicity and similarity of structure. As a corollary of this, electron microscopy thus far has refined and confirmed rather than revolutionized concepts of pollen wall morphology.

Mesine is proposed as a new term for the laminated, electron-dense layer between the intine and exine. This term is also used at present to refer to electron-dense laminated material found in a supraexinous position.

Lamellations of differing electron-densities are described for the intine.

Most mature pollen grains observed were covered by a perine layer which was closely appressed to the exine surfaces. The simultaneous appearance of the perine and the disappearance of the plasmodial tapetum in T. paludosa suggests that the perine may be derived from the tapetum.

General physical and chemical relationships of the pollen wall are discussed using cutinized epidermal cells as a model.

In the Commelinaceae evidence drawn from sterile grains adds no support for the theory of exine deposition without direct participation of the pollen grain protoplast.

Pollen evidence is presented in support of the establishment of the distinctive genus Commelinantia containing the species C. anomala and C. Pringlei.

A double fixation schedule using buffered formalin and osmium tetroxide was found to give favorable preservation of the internal structure of pollen grains in this family.

109 pages. $2.00. Mic 57-3017

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CHEMISTRY, GENERAL

INVESTIGATIONS OF COLOR SYSTEMS AND METHODS (PARTS I-IV)

(Publication No. 21,292)

William George Krochta, Ph.D.
Purdue University, 1957

Major Professor: M. G. Mellon

An investigation was made to develop an indirect, absorptimetric method for the determination of small amounts of cesium (less than one mg.). The method involves precipitation of cesium with excess tungstosilicic acid, with subsequent development of a heteropoly-blue color by reduction of the excess precipitant with titanium trichloride reagent. As this color system has an absorption peak at 725 mμ, all measurements were made at that wavelength. Inasmuch as washing and further handling of the precipitate are eliminated, the method is rapid. Once the calibration curve has been established and the samples prepared, as many as 5 determinations may be run within an hour. The determination may be performed in the presence of limited amounts of potassium and rubidium. The method is not as sensitive as some hitherto described, and there are a number of interferences with the color reaction.

The results of the studies of precision and accuracy indicate that the method is accurate for samples containing o.133 to 0.931 mg./ml. of cesium and the reproducibility allows an error of ± 1.91% cesium.

A literature survey for the period 1934 to 1956 was made for compounds which form quantitatively insoluble precipitates with heteropoly acids. More than 100 references, along with the precipitate and its corresponding formula, were listed. Although there are often several formulas given for the same compound, only one formula was listed.

An investigation was made of the absorptimetric method of Terada for determining phosphorus by means of the strychnine molybdophosphate precipitate. Accurate results were not obtained by the original recommended procedure; consequently, a study of the effect of variables was made. Optimum conditions were ascertained and an ethanol wash solution was found to give somewhat better results, although they still were not accurate enough for quantitative determinations.

The absorption spectrum of tungstoboric acid was studied for its analytical possibilities. As tungstoboric acid is not colored, its spectrum was scanned in the ultraviolet region. An absorption peak at 257 mμ was attributed to tungstoboric acid. Attempts to reduce tungstoboric acid to a heteropoly-blue produce were unsuccessful. From this study it does not appear that tungstoboric acid can be utilized in a direct absorptimetric method for boron.

149 pages. $2.00. Mic 57-3018

STUDIES ON THE CHEMISTRY OF HALOGEN AND INTERHALOGEN COMPLEXES

(Publication No. 22,101)

Ralph Howard Rygg, Ph.D.
State University of Iowa, 1957

Chairman: Professor Alexander I. Popov

Some halogens and interhalogens are known to form complexes resulting from a postulated Lewis acid-base interaction. In these complexes the halogens are the acceptors of electron pairs and the donors may be a halide ion (forming the polyhalide ions) or organic nitrogen-bases, aromatic compounds, etc., (forming molecular complexes).

The present investigation was conducted to clarify (by means of conductance measurements) the nature of the anionic species present in solutions of polyiodide compounds in acetonitrile and nitrobenzene. In addition, the stabilities, in carbon tetrachloride, of molecular complexes of ICl, IBr and I_2 with pyridine, 2-picoline and 2,6-lutidine were determined by spectrophotometric measurements; these results were expected to confirm the acid-base theory for such interactions.

Conductance measurements were made on solutions of the compounds of tetramethylammonium and tetrapropylammonium polyiodide series in acetonitrile. At concentrations of about 10^{-2} M, a decrease in equivalent conductance was observed with increase in iodine content; tetramethylammonium iodide, however, deviated from this pattern and showed the lowest equivalent conductance of all the tetramethylammonium compounds. Viscosity measurements did show quite satisfactorily that the decrease in equivalent conductance was not due to the increased viscosity of the solutions due to the addition of iodine.

The Fuoss-Shedlovsky method was applied and the limiting equivalent conductances and the ion pair dissociation constants of the compounds were thus obtained.

Conductimetric titrations, and differential plots of the results, showed a sharp break in the curves after the composition of the heptaiodide was reached. The heptaiodide ion appeared to exist, with considerable dissociation, at the concentration of about 10^{-2} M. The pentaiodide ion appeared to be very stable at the high concentrations, however, only the triiodide ion was stable below concentrations of about 2×10^{-4} M.

Conductance measurements were made on the triiodides and the pentaiodides, of the above two series, in nitrobenzene. The limiting equivalent conductance and the ion pair dissociation constants were only determined for the triiodide compounds as the results for the pentaiodides were rather nebulous.

Stable solid compounds of ICl and IBr with 2,6-lutidine, 2-picoline and pyridine (previously prepared) were formed and analyses showed them to be 1:1 addition compounds.

Results of the mole ratio method and the method of continuous variation showed that IBr and ICl formed 1:1 complexes with lutidine, picoline and pyridine in carbon

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tetrachloride. The instability of the iodine complexes prevented the satisfactory use of the two above methods, but it is assumed that the 1:1 complexes were again formed.

The dissociation constants of the complexes were determined from the spectrophotometric measurements. The order of stability of the halogen complexes was as follows: ICl > IBr > I_2. In each of the halogen series the order of stability of the complexes was as follows: Picoline > Pyridine > Lutidine. 164 pages. $2.15. Mic 57-3019

ANALYTICAL APPLICATIONS OF A. C. POLAROGRAPHY

(Publication No. 22,211)

Robert Alvin Schreiber, Ph.D.
Cornell University, 1957

This study was concerned with the exploration of analytical applications of alternating current polarography.

The dependence of the a.c. peak height on the frequency and amplitude of the impressed alternating voltage was studied. Concentration studies of inorganic reversible reductions were made in various supporting electrolytes, and it was found that the a.c. peak height was greatly dependent on the media used. Thus it was possible, by proper selection of supporting electrolyte, to minimize the effect of interfering ions. Mixtures of ionic species which would be difficult or impossible to resolve by conventional d.c. polarography were easily determined by a.c. methods.

Organic compounds were studied by the a.c. method and it was found that the reversible organic reductions gave a much higher sensitivity than could be obtained by conventional d.c. polarography. The organic compounds studied were aromatic nitro compounds, azobenzene, azoxybenzene, benzaldehyde, salicylaldehyde, and fumaric and maleic acids. The study of aromatic nitro compounds in 1M sodium hydroxide was shown to give a.c. peaks due to the azoxybenzene formed as a result of the strong alkali.

112 pages. $2.00. Mic 57-3020

CHEMISTRY, BIOLOGICAL

THE METABOLISM OF ITACONIC ACID BY ANIMAL TISSUES

(Publication No. 22,313)

Julius Adler, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Henry A. Lardy

Mitochondria from guinea pig liver in the presence of Mg^{++} catalyze the complete oxidation of itaconic acid. Methylsuccinate and mesaconate are oxidized slowly, and citraconate, dl-citramalate, β-methylmalate, paraconate, and itamalate not at all. Soluble extracts of acetone powder of guinea pig or rat liver mitochondria metabolize itaconate to mesaconate, acetate, lactate, malate, citrate, α-ketoglutarate, and glutamate, if Mg^{++}, adenosine triphosphate, and coenzyme A are added.

The first step in this metabolism is the activation of itaconate to itaconyl coenzyme A. Succinate activating enzyme in the presence of Mg^{++}, a nucleoside triphosphate, and coenzyme A catalyzes this activation. The extracts catalyze the reversible isomerization of itaconyl coenzyme A to mesaconate and coenzyme A.

The major reaction of itaconyl coenzyme A in these extracts is a cleavage to acetyl coenzyme A and pyruvate. The reduction of pyruvate to lactate by diphosphopyridine nucleotide provides a spectrophotometric assay for this reaction. Mesaconate, citraconate, methylsuccinate, d- or dl-citramalate, itamalate, and paraconate are inactive as substrates.

In the presence of itaconate the extracts catalyze the fixation of carbon dioxide. The probable pathway is the fixation of carbon dioxide by pyruvate from the cleavage of itaconyl coenzyme A. The product, oxalacetate, then combines with the acetyl coenzyme A from the cleavage to form citrate, α-ketoglutarate, and glutamate.

96 pages. $2.00. Mic 57-3021

MONO ACYL DERIVATIVES OF CHYMOTRYPSIN

(Publication No. 22,244)

Frank Leslie Aldrich, Jr., Ph.D.
Purdue University, 1957

Major Professor: A. K. Balls

Studies have been conducted on the reaction between α-chymotrypsin and several nitrophenyl esters of carboxylic acids. The reactions were followed by spectrophotometric measurement of the nitrophenol liberated during the hydrolysis. In all cases in which hydrolysis was observed, the hydrolysis curves consisted of a very rapid initial phase followed by a slower linear phase. These curves are interpreted as indicating the formation of relatively unstable acyl enzymes as intermediates.

A study of the effects of ethanol and several other materials having amino or alcoholic groups gave indications of transesterification reactions occurring.

The presence of inactive acyl enzyme intermediates was confirmed by isolation of several such acyl enzymes from reaction mixtures of chymotrypsin and nitrophenyl esters at pH 5.0.

Some of the reactions of the acyl chymotrypsins have been studied. The formation of hydroxamic acids in the reaction with hydroxylamine and the liberation of acid on standing in solution at pH 6.5-8.7 both corroborated the indications of the hydrolysis curves that the acylated enzyme contained one mole of acyl group per mole (25,000 grams) of chymotrypsin.

Active chymotrypsin was found to be regenerated from the inactive acyl enzymes by raising the pH of their solutions to pH 7.5 for a few minutes.

Both p-nitrophenyl acetate and acetyl chymotrypsin were prepared containing radioactive carbon (C^{14}) in the acetyl group. The radioactive acyl enzyme was employed

to study the transesterification reaction with ethanol, the relative rates of loss of acetyl and liberation of nitrophenol from p-nitrophenyl acetate by acetyl chymotrypsin, and the possibility of an exchange reaction with L-tyrosine ethyl ester. 54 pages. $2.00. Mic 57-3022

ASSIMILATION OF CARBON DIOXIDE BY THE HYDROGEN BACTERIA

(Publication No. 22,319)

Fred Heinz Bergmann, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Robert H. Burris

Autotrophic organisms are those whose sole source of carbon is carbon dioxide. The energy for the assimilation of carbon dioxide may be supplied by light (photosynthesis) or by simple reduced inorganic compounds (chemosynthesis). Fewer studies have been made on chemoautotrophs than on photosynthetic organisms. This is due both to difficulties in the culture of chemoautotrophs and to the much greater relative importance of photosynthesis in maintaining life on this planet. However, chemoautotrophic organisms deserve further study because of their inherent theoretical interest and their role in several important transformations of inorganic compounds in the soil.

Hydrogenomonas facilis is a facultative chemoautotroph whose energy can be derived exclusively from the oxidation of hydrogen to water. The mechanism of autotrophic carbon dioxide fixation in this organism was studied by means of the radioactive isotope C^{14}. Both cell-free systems and actively growing cultures were investigated. The products of the fixation were analyzed by several chromatographic methods.

Carbon dioxide fixation by cell-free preparations of H. facilis was markedly stimulated by the addition of ribose-5-phosphate. Adenosine triphosphate, when added in very low concentrations, stimulated the ribose-5-phosphate dependent fixation by 30 to 100 per cent, but higher levels had a strong inhibitory effect. Hydrogen, 5-phosphoribonic acid, and phosphate also inhibited the fixation. The main products of the reaction always were found to be malic and fumaric acids. These products could arise by a variety of metabolic reactions, and the mechanism of their formation and the role of ribose-5-phosphate remains uncertain.

In contrast to cell-free preparations, whole cells assimilate $C^{14}O_2$ much more rapidly. After a few minutes of exposure to $C^{14}O_2$, many acid-soluble metabolites, as well as proteins and nucleic acids, become labeled. However, when cells are exposed to $C^{14}O_2$ for 5 to 15 second, the major part of the assimilated radioactivity is found in sugar phosphates and phosphoglyceric acid. Some radioactive malic acid also is found as a result of these very short exposures. Kinetic analysis of these data shows that the other cell constituents must have arisen from these very early products.

This study indicates that Hydrogenomonas facilis, and perhaps other chemoautotrophs, have a mechanism of carbon dioxide assimilation different from organisms using reduced carbon compounds (heterotrophs). The distribution of labeled compounds after very short exposures to $C^{14}O_2$ is very similar to that found with photosynthetic tissue. This indicates that a mechanism of carbon dioxide assimilation similar to that found in photosynthesis is probably operative in the hydrogen bacteria.

113 pages. $2.00. Mic 57-3023

THE OCCURRENCE OF A FREE AMINO ACID POOL IN CULTURES OF CLAVICEPS LITORALIS, KAWATANI

(Publication No. 21,197)

Marvin Lawrence Berman, Ph.D.
University of Washington, 1957

A quantitative growth study of Claviceps litoralis, Kawatani has been made in a chemically defined medium. Using the method of paper partition chromatography, aqueous extracts of the mycelial tissues from the growth study were examined qualitatively and quantitatively for the presence of free amino acids. From the results of this analysis, it was concluded that a free amino acid pool exists in the mycelial tissues. The changing nature of this amino acid pool is described, as are also the various amino acid concentrations during mycelial growth.

The medium used for mycelial growth consisted of mannitol and yeast nitrogen base which contained in addition to the amino acids, l-histidine, d-l-tryptophan and d-l-methionine, such nutrient factors as trace elements and vitamins.

From the results of the quantitative growth study, a typical growth curve has been constructed. This shows the maximum growth was achieved in 40 days during which there was a 45-fold increase in mycelial growth. The results indicate that there was a correlation between growth and hydrogen ion concentration of the medium. Under the conditions of this study no alkaloids could be detected in the substrate or mycelial tissues.

The culture filtrate from the growth study was also analyzed for the presence of free amino acids, and these were identified. The results indicated that the amino acids originally present in the medium were utilized by the fungus during growth.

Several methods for extraction of amino acids from the powdered lyophilized mycelial tissues were compared. The boiling water method was more efficient in extracting amino acids, than extraction of the tissues with 70 per cent alcohol or cold 5 per cent trichloroacetic acid.

92 pages. $2.00. Mic 57-3024

SKIN STEROLS IN HYPERPLASIA

(Publication No. 22,321)

Samuel Carroll Brooks, Jr., Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Carl A. Baumann

Frozen sections of rat and mouse skin were treated with concentrated Liebermann-Burchard reagent, and an immediate but transient blue color due to Δ^7-sterols was observed in the sebaceous glands. Under these conditions the cholesterol in an atherosclerotic aorta formed a blue-green color at a much slower rate. These differences in color formation paralleled known differences between cholesterol and Δ^7-sterols as pure crystals or in solution. Procedures known to diminish the Δ^7-cholestenol concentration and increase the amount of cholesterol in skin (application of carcinogens for 6 days) resulted in the degeneration of the sebaceous glands and a decrease in sudanophilic material. Such epidermis also showed a decrease in fast-acting chromogen with the Liebermann-Burchard reagent. Procedures that increased the thickness of the epidermis and the amount of cholesterol without causing a change in the amount of Δ^7-cholestenol (application of long chain alkanes and alkenes) produced slightly hypertrophied, sudanstainable sebaceous glands. These glands developed a normal fast-acting color upon addition of the Liebermann-Burchard reagent.

The application of alkyl aldehydes, alcohols, acids, and certain mercaptans to skin produced an epidermal hyperplasia similar to that caused by the corresponding alkanes: an increase in epidermal weight and in cholesterol without a change in Δ^7-cholestenol or in the appearance of the sebaceous glands. The application of cyclohexylbenzene or small amounts of an ether solution of octadecylmercaptan produced a hyperplasia in which the amount of epidermal Δ^7-cholestenol was decreased. Neither of these latter treatments produced a microscopically demonstrable change in the sebaceous glands. Larger doses of the mercaptan produced structural alterations of the epidermis with a decrease in Δ^7-cholestenol.

Alkyl amines 10 to 18 carbon atoms long proved to be potent hyperplastic agents which also caused increases in Δ^7-cholestenol. Thirty milligram applications of octadecyl amine destroyed the sebaceous glands, while 3 mg. applications left the glands intact but still induced an increase in the Δ^7-sterol. The continuous application of croton oil or of tetradecyl amine produced skin tumors in mice sensitized by an early exposure to creosote; octadecylmercaptan produced skin tumors only in mice that were pretreated with 7,12-dimethylbenz(α)anthracene.

The green pigment formed from cholesterol and the Liebermann-Burchard reagent was separated as an ether-insoluble sulfonic acid. The neutralization equivalent, elemental analysis, barium salt, and phenylhydrazine salt suggested the pigment to be a sulfonic acid with two acid groups per steroid nucleus. This nucleus apparently had two double bonds and a carbon skeleton three or four carbon atoms smaller than cholesterol.

In studies on the incorporation of acetate into sterols, skin slices from rats and mice were incubated with $CH_3C^{14}OONa$ and the sterols separated into the Δ^5- and Δ^7-fractions. The specific activity of the Δ^7-cholestenol fraction from rat skin was 3-4 times that of the "cholesterol" fraction, while with mouse skin the specific activity of the Δ^7-sterol fraction was about 25 times that of the Δ^5-fraction. Unesterified Δ^7-sterols, although present in very small amounts, had the highest specific activity and in some preparations from rat skin the 7-dehydrocholesterol component was more active than Δ^7-cholestenol. Purification of the "cholesterol" fraction indicated the presence of two "high counting companions," one of which preceded cholesterol on an alumina column while the other followed cholesterol. These companions and Δ^7-cholestenol with high specific activity were also found in incubated liver. 94 pages. $2.00. Mic 57-3025

STUDIES ON THE INDUCTION OF ENZYME SYNTHESIS IN THE RAT BY POLYCYCLIC AROMATIC HYDROCARBONS

(Publication No. 20,229)

Allan Howard Conney, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor James A. Miller

This report is concerned with the induction of enzyme synthesis in the rat liver by polycyclic aromatic hydrocarbons and with the properties and cofactor requirements of these enzyme systems. It was found that administration of certain of these hydrocarbons stimulated the synthesis of three hepatic microsomal enzyme systems in the rat. These systems catalyze 1) the oxidative N-demethylation of aminoazo dyes (demethylase), 2) the reduction of the azo linkage of aminoazo dyes (reductase), and 3) hydroxylation of the hydrocarbon 3,4-benzpyrene (hydroxylase). The substrates used to assay for these enzyme systems in vitro were 3-methyl-4-monomethylaminoazobenzene, 4-dimethylaminoazobenzene, and 3,4-benzpyrene, respectively.

Young rats were injected intraperitoneally with varying levels of hydrocarbons and were killed at intervals after the injection. The livers were removed, homogenized and incubated with the substrate in a medium containing triphosphopyridine nucleotide, diphosphopyridine nucleotide, and an oxidizable substrate such as glucose-6-phosphate or hexose diphosphate.

The intraperitoneal injection of 1 mg. of 3-methylcholanthrene doubled the azo dye demethylase activity by six hours, tripled it by twelve hours and caused a five-fold increase by 24 hours. This same treatment doubled the azo reductase activity by 24 hours and caused a three-fold increase by three days. The injection of 1 mg. of 3,4-benzpyrene caused a three-fold increase in benzpyrene hydroxylase by three hours, a five-fold increase by six hours, and almost a ten-fold increase by 24 hours. The activities of all three enzyme systems returned to normal at later times. These three systems were stimulated about equally by the injection of 1 mg. of 3-methylcholanthrene, 3,4-benzpyrene, or 1,2,5,6-dibenzanthracene. Many other hydrocarbons were tested for their ability to increase demethylase activity, and it was found that there was no correlation between the activity of the hydrocarbon as a local carcinogen and the ability of the hydrocarbon to increase demethylase activity. Evidence is presented that the hydrocarbons

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increased the activities of these enzyme systems by stimulating the synthesis of new enzyme rather than by activating pre-existing enzyme. Thus, no evidence for the involvement of activators or inhibitors could be found. Furthermore, administration of the amino acid antagonist ethionine just prior to hydrocarbon administration inhibited the stimulatory effect of hydrocarbon on all three systems, and this inhibitory effect of ethionine was prevented by the simultaneous administration of the natural amino acid methionine.

Studies on the demethylase and hydroxylase systems have shown that these enzymes are localized in the microsomes of the liver cell, and require a source of reduced triphosphopyridine nucleotide, reduced diphosphopyridine nucleotide and oxygen for maximum activity.

The major products of the metabolism of benzpyrene by fortified liver homogenates were found to be 8-hydroxybenzpyrene, 10-hydroxybenzpyrene and the metabolite termed F_1, previously observed in vivo by Weigert and Mottram. Smaller quantities of benzpyrene-5-8-quinone, benzpyrene-5,10-quinone, 5,8-dihydroxybenzpyrene, and two unknown metabolites were observed. Evidence is presented that F_1 is a monohydroxybenzpyrene but that it is not 10-hydroxybenzpyrene as suggested by Berenblum and Schoental.

These hydrocarbons apparently induce synthesis of only specific hepatic enzymes, for although the administration of 3-methylcholanthrene greatly stimulated liver growth and the synthesis of demethylase, reductase, and hydroxylase, it was found to have only a small effect on the activity of the in vitro system which incorporates alanine-1-C^{14} into liver protein and no effect on catalase and glucose-6-phosphatase. 97 pages. $2.00. Mic 57-3026

A STUDY OF THE CHEMICAL DEGRADATION OF ASCORBIC ACID IN MODEL SYSTEMS

(Publication No. 22,333)

Miriam Nurnberg de Salegui, Ph.D.
The University of Wisconsin, 1957

Supervisors: Professors Robert M. Bock and J. N. Williams, Jr.

Ascorbic acid incubated at neutral or slightly acid pH in a buffer prepared from analytical-grade sodium phosphate and singly-distilled water was rapidly degraded to products not possessing an intact six-carbon chain. The degradation was proportional to the concentration of phosphate in the buffer and could be prevented by high concentrations of chloride ion, by depriving the system of oxygen, or by 8-hydroxyquinoline. When ascorbic acid was replaced by synthetic dehydroascorbic or diketogulonic acids, these compounds too were degraded but at a much slower rate than when they were formed in the system by the oxidation of ascorbic acid or when ascorbic acid was simultaneously added. The degradation of dehydroascorbic and diketogulonic acids was also proportional to the concentration of phosphate in the buffer. It could be prevented by depriving the system of oxygen but was reduced only slightly by 8-hydroxyquinoline and was not affected by chloride ions. When ascorbic acid was oxidized, hydrogen peroxide was produced and consumed during the course of the degradation. Smaller amounts of peroxide were detected when dehydroascorbic or diketogulonic acids were used as substrates. The rate of oxidation and degradation of ascorbic acid was markedly reduced when the water used to prepare the buffer was triply-distilled and when precautions were taken to avoid spurious contamination of the system from traces of heavy metals in atmosphere or reaction vessels. Under anaerobic conditions dehydroascorbic acid appeared to undergo quantitative dismutation to ascorbic acid and a yellow oxidized derivative. The dismutation was independent of the presence of phosphate. Emission spectroscopic analysis showed that the phosphate used to prepare the buffer was contaminated with 0.1 to 1 ppm of iron, lead, manganese, aluminum and strontium. A mechanism consistent with all of the above observations is proposed to account for the degradation of ascorbic and dehydroascorbic acids in sodium phosphate buffer.

The oxidation of ascorbic acid was studied in rigorously simplified systems with ionic or chelated iron as the oxidation catalyst. Quantitative observations of the rate of oxidation and degradation were correlated with qualitative surveys of the products formed as a function of time in the reaction mixtures. At pH 6.8 and 37° C. the oxidation of ascorbic acid catalyzed by iron or by iron complexed with ethylenediamine tetraacetic acid [EDTA] appeared to be first-order with rate constants equal to .064 $min.^{-1}$ and .105 $min.^{-1}$ respectively. Iron also catalyzed the degradation of ascorbic acid beyond the diketogulonic acid stage and EDTA accelerated the rate of this degradation. The kinetics of the degradation were not first order. A variety of carbonyl compounds were formed during the course of the iron-catalyzed degradation and many of these appeared themselves to be degraded when the iron was complexed with EDTA. Hydrogen peroxide was detected in the reaction mixtures. The end-products appeared to be the same whether the degradation was catalyzed by iron or by iron complexed with EDTA. The behavior of ascorbic, dehydroascorbic and diketogulonic acids in 19 solvent systems and a new method for detecting organic acids on paper chromatograms are also reported.

Model systems were used to investigate the possibility that ascorbic acid as a hydroxylating agent might accomplish the synthesis of hydroxyproline from proline, analogs of proline or immediate metabolic precursors of proline in the presence of a metal-chelate as activator. In an ascorbic system with ascorbic acid, or with dehydroascorbic acid plus hydrogen peroxide in an anaerobic system, no hydroxyproline was formed from proline, acetylproline, ornithine or glutamic acid when iron or manganese was used as the metal activator and EDTA, β-aminopropionitrile, diethylenetriamine pentaacetate, or 1,2-diaminocyclohexane tetraacetate was used as the chelating agent.
97 pages. $2.00. Mic 57-3027

AMINO ACID IMBALANCES IN LOW PROTEIN DIETS

(Publication No. 22,334)

Pandurang Dattatraya Deshpande, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Conrad A. Elvehjem

In an attempt to improve the low quality proteins of cereals by amino acid supplementation, imbalances of amino acids are produced. The present study consists in devising ways and means in overcoming these imbalances.

When rice formed the entire source of protein in the diet, which was adequate with respect to other known nutrients, growth was poor (8 g/wk) and fat accumulated in the livers of the experimental animals to the extent of 30 percent, expressed on dry weight basis. When the diet was supplemented with 0.2% L-lysine and 0.24% DL-threonine, growth was improved but liver fat values were still high. Increasing the quantities of lysine and threonine to double the original levels, resulted in normal livers, but growth was depressed. The growth depression was overcome by the addition of the 4 amino acids, leucine, isoleucine, valine and histidine. Supplementing the diet with 6 percent of purified animal proteins improved the growth and the liver fat values were normal.

In case of the refined wheat flour, higher levels of lysine and threonine (.5 and .4% respectively) were needed to bring about a growth response, similar to that obtained with the lower levels of these amino acids when rice formed the source of protein. Further improvement in growth was obtained only when 7 more amino acids were added. No accumulation of fat was observed in any of the groups fed on wheat flour, supplemented with amino acids. When however, the level of protein was reduced from 9.6 to 5.4 percent (equivalent to that supplied by rice) fat accumulated in the liver when a lysine deficiency was created by adding threonine. When the wheat flour diet was supplemented with intact protein of animal origin and the deficiencies which still existed, were met by adding crystalline amino acids, maximum growth was obtained. It is concluded from these results that the practical method of improving low quality proteins of vegetable origin is by supplementation with animal proteins.

In studies with fibrin diets, it was observed that when methionine and phenylalanine were added to a 6 percent fibrin diet, a complex imbalance involving leucine, isoleucine, valine and histidine was created. When these four amino acids were present in the diet, maximum growth was obtained only when methionine and phenylalanine were included. When all the six amino acids were added, growth was stimulated but at the same time fat accumulated in the liver. These fatty livers responded to lysine or threonine and the combination was more effective.

Replacing sucrose, which was used as the carbohydrate, by dextrin, did not change the amino acid imbalance picture, although the growth was proportionately improved in all cases.

Nitrogen retention studies showed that with the imbalance diet, the animals eat less and at the same time the percent nitrogen retention is decreased so that this two fold effect results in severe growth depression.

The studies on biological availability of amino acids suggest that in the nutritional evaluation of proteins by their amino acid composition, it is not sufficient to determine the content of various amino acids and equate them to the accepted requirements. Information on the actual availability of the amino acid by the organism is more important. 103 pages. $2.00. Mic 57-3028

PROTEINURIA AND LIPIDURIA

(Publication No. 22,344)

John Sylvester Finlayson, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Carl A. Baumann

The protein fraction of normal rat and mouse urine was found to contain lipid including cholesterol and "fast-acting" sterol. Rats excreted an average of about 2 μg of the fast-acting sterol per day; mice, 2 μg and 0.2 μg, respectively. Salt precipitation and electrophoretic fractionation showed the sterols of rat urine to be bound to both albumin and globulin, cholesterol being more concentrated in the globulins. The excretion of protein-bound cholesterol varied with age, sex, species, and strain; it was increased greatly by injecting Δ^7-cholestenol, somewhat by injecting cholesterol or by feeding a high fat diet, and only slightly by feeding a high protein diet; it was not altered by high dietary cholesterol, by glomerulonephritis due to N,N'-diacetylbenzídine, nor by the presence of a hepatoma. Only 26% of the urinary cholesterol of the rat was esterified, whereas in serum 78% is esterified.

Analyses of the urogenital tract showed fast-acting sterol to be present only in traces in the kidney, but to constitute up to 11% of the total sterol of the bladder. Rodent bladders showed the highest content of fast-acting sterol; the dog, an intermediate level; livestock, very little. In rodents and in the dog most (61-84%) of the fast-acting sterol was 7-dehydrocholesterol. All bladder sterol was unesterified.

Both cholesterol and fast-acting sterol were concentrated in the mucosa of the bladder, the fast-acting sterol showing the greater concentration gradient in this respect. Tissue slices of dog bladder incubated with $CH_3C^{14}OONa$ in vitro incorporated labeled acetate into both the Δ^7-sterol and the cholesterol fraction, the specific activity of the Δ^7-sterol being about 50 times that of the cholesterol fraction.

Protein excretion by the mouse (0.6-3.1 mg protein N per day) was much higher than that of the rat, the difference being further emphasized by expressing the results on a body weight basis. Moreover, whereas the proteins of rat urine were all major serum components, electrophoretic measurements showed mouse urinary protein to consist of 3 components, all more electronegative than serum albumin. The most electronegative of these, amounting to 32% of the total urinary protein, had an isoelectric point of pH 4.3; the most electropositive, of pH 4.5. When subjected to ultracentrifugation, these proteins sedimented as a monodisperse system with a sedimentation coefficient of 2.28 S and an average molecular weight of 20,000. During the electrophoresis of mouse serum a small component which may be the urinary protein migrated faster than albumin at pH 8.5.

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Spaced feeding, utilizing rats trained to eat for only 2 hours per day, had been shown in previous proteinuria experiments to induce striking differences in growth patterns. This technique was used to compare the protein quality of raw and autoclaved torula and brewers' yeast with that of casein. Under these conditions, autoclaving appeared to improve the nutritive value of the yeast when supplemented at high levels to diets containing 12% of casein. Autoclaving caused no improvement in yeast fed as the sole source of protein, fed under ad libitum conditions, or supplemented to casein at lower levels. In this last situation torula yeast was as good a supplement to casein as was brewers' yeast or additional casein. Evidence was also obtained of adaptive changes taking place during training for spaced feeding.

80 pages. $2.00. Mic 57-3029

STUDIES ON THE RELATION OF MOLDS AND MOLD PRODUCTS TO "SICK WHEAT" AND OTHER TYPES OF DAMAGE IN STORED WHEAT

(Publication No. 22,490)

Moishe Golubchuk, Ph.D.
University of Minnesota, 1957

Adviser: W. F. Geddes

Molds are invariably associated with deterioration in stored wheat but their role in causing spoilage is obscure. Present methods of detecting wheat damage in the initial stages of deterioration are of limited value. The objectives of the present study were to determine the importance of molds in the spoilage of wheat stored at moisture levels below 14% and to investigate cellular and extracellular products of mold growth with a view to developing a reliable quantitative method for detecting incipient wheat deterioration.

Surface-disinfected and mold-inoculated samples of hard red spring wheat were stored at 24°C and 38°C and approximately 12% moisture for periods up to one year. The mold counts of the majority of the samples decreased during storage but fat acidity continued to increase at both temperatures. Although no significant increase in germ damage was detectable in the samples stored at 24°C and in the surface-disinfected samples at 38°C, germ damage increased sharply in the mold-inoculated samples stored at 38°C. This demonstrated that greater germ damage can be caused by a combination of high temperature and mold infection than by either factor alone.

Reducing sugar and amino nitrogen determinations were made on a number of these wheat samples in an exploratory study designed to investigate the theory that germ damage was caused by a non-biological browning reaction of the Maillard type. The percentage of reducing sugars increased as the fat acidity increased up to fourfold and the viability dropped from 93% to as low as 3%. However, the increase in percentage of reducing sugars bore no simple mathematical relationship to the increase in germ damage. Total free amino nitrogen values were quite similar but in the samples stored at 38°C, those exhibiting the highest germ damage had lower values for free amino nitrogen.

The development of a chemical method for estimating mold contamination in wheat based on its glucosamine content was investigated. The glucosamine content of sound wheat of high viability and low fat acidity varied from 15 to 59 ppm. Heavily mold-infested wheat had a glucosamine content of 384 ± 9 ppm. The method offers promise in predicting wheat deterioration but before becoming of general practical value it will have to be simplified and its replicability improved.

The isolation, nature and properties of material secreted by Aspergillus flavus which is toxic to seed viability were studied. Using ion-exchange resins, an acidic toxic mixture was isolated from shake culture filtrates of the mold grown on an aqueous wheat extract. Several individual toxic components were isolated by elution chromatography on silicic acid. The most toxic component produced germ damage in addition to inhibiting wheat respiration and lowering the viability of the grain.

A partial determination of the structure of the most toxic component showed it to be an acidic heteromeric peptide which contained glycine as a free C-terminal residue but contained no free N-terminal residues. Thirteen amino acids were identified and quantitatively determined using ionophoresis, ion-exchange and paper chromatography. These amino acids in order of decreasing molar ratios were glycine, glutamic acid, aspartic acid, proline, threonine, serine, cysteic acid, isoleucine, leucine, alanine, valine, tyrosine and phenylalanine.

131 pages. $2.00. Mic 57-3030

EFFECT OF ESTRADIOL ON THE METABOLISM OF ONE CARBON FRAGMENTS IN THE RAT UTERUS

(Publication No. 22,361)

Ailene Marie Herranen, Ph.D.
The University of Wisconsin, 1957

Supervisor: Associate Professor Gerald C. Mueller

Following the single injection of a natural estrogen the uterus of the ovariectomized rat responds with a period of rapid growth. In an attempt to localize the site of estrogen action and to characterize the mechanism by which latent growth processes are mobilized by the hormone a survey of metabolic pathways at early time periods following hormonal stimulation has been undertaken. As a part of these survey studies the metabolism of one carbon fragments has been studied in surviving uterine segments.

Ovariectomized rats were injected in the tail vein with 1 ml. of a buffered saline containing 10 μg. of estradiol-17β; control rats received buffered saline only. After six hours the uterine horns were removed. The segments were incubated in vitro for 2 hours at 37°C. under an oxygen atmosphere in Robinson's medium containing glucose various combinations of radioactive and nonradioactive substrates. The incorporation of radioactivity into various fractions of the tissue was measured.

The incorporation of glycine-2-C^{14} and formate-C^{14} into the protein was stimulated 2 and 3 fold respectively by 6 hours estrogen pretreatment. The incorporation into the lipide fraction was also stimulated. A striking response to estrogen pretreatment was revealed by a 3 to 5

fold increase in the incorporation of these precursors into the nucleic acid purines. The incorporation of the glycine and the formate into acid soluble serine was increased respectively to 2 and 3 times the control level. Under the same conditions the incorporation of radioactive formaldehyde into the various fractions was not significantly stimulated. The oxidation of the radioactive precursors to carbon dioxide was not affected by estrogen pretreatment.

These studies revealed that one carbon metabolic pathways were highly sensitive indicators of early estrogen action and were extended with serine-3-C^{14} as the labeled precursor. The incorporation of radioactivity into the purine bases of nucleic acids was accelerated 5 to 6 fold by 6 hours estrogen pretreatment. The incorporation into protein and oxidation to carbon dioxide were accelerated 2 fold; no effect was observed in the lipide fraction. The addition of nonradioactive formate to the reaction flask acted as a trap for the one carbon unit derived from the serine-3-C^{14} thereby obscuring the effect of the estrogen on the one carbon pathway into purines and carbon dioxide. Determination of the amount of radioactivity trapped by the pool of nonradioactive formate demonstrated that the estrogen pretreatment had accelerated the metabolic reactions yielding formate from serine-3-C^{14}.

These studies demonstrating the increased incorporation of glycine-2-C^{14} and formate-C^{14} into acid soluble serine and the stimulation of conversion of serine-3-C^{14} to formate, prompted an investigation of the effect of estradiol pretreatment on the level of serine aldolase in the rat uterus. The synthesis of serine was studied in uterine homogenates prepared in a sucrose medium. In the presence of tetrahydrofolic acid, formaldehyde and glycine-2-C^{14}, the incorporation of radioactivity into the serine was linear with time (30 minutes) and proportional to tissue concentration. Attempts to convert formate-C^{14} to serine were unsuccessful.

Uterine homogenates from rats pretreated with estradiol exhibited higher serine aldolase activity. During a period of 18 hours following a single 10 μg. dose of estradiol, the serine aldolase activity increased linearly with time to 4 times the control level. Thus one of the early effects of estrogen on uterine metabolism has been demonstrated as a change in enzymatic activity.

58 pages. $2.00. Mic 57-3031

THE CHARACTERIZATION OF SUBCELLULAR PARTICULATE FRACTIONS ISOLATED FROM PEANUT COTYLEDONS

(Publication No. 22,375)

Emil Phillip Kmetec, Ph.D.
The University of Wisconsin, 1957

Supervisor: Associate Professor Eldon H. Newcomb

The cytoplasmic particles in homogenates of germinating peanut cotyledons were fractionated and characterized, and metabolic studies were carried out with the fraction consisting predominantly of mitochondria.

The particulate fractions were prepared from etiolated peanut seedlings (Arachis hypogea var. "Jumbo") by grinding the cotyledons in a mortar with sand and a sucrose-phosphate solution at pH 7.4. The particles separated by differential centrifugation were characterized by their appearance in the phase and electron microscopes, response to janus green B, succinoxidase and palmitic-1-C^{14} oxidase activities, and content of ribonucleic acid and of metallic elements.

Three particulate fractions were separable, consisting predominantly of starch and aleurone granules, mitochondria, and microsomes, respectively. The particles in the mitochondrial and microsomal fraction were spherical and exhibited a continuous gradation in diameter from several microns in the mitochondrial fraction to about 20 mμ in the microsomal, with overlapping of sizes between the fractions. Electron micrographs and ribonucleic acid analyses indicated that the mitochondrial fraction was contaminated with microsomes. Only the particles in the mitochondrial fraction were able to oxidize succinate and oxidize and reduce janus green B. A highly purified mitochondrial fraction, prepared by a density barrier technique, had similar enzymatic properties. In addition, the mitochondrial fraction oxidized Krebs cycle acids and ferrocytochrome c with concomitant phosphorylation. Elemental analysis by emission spectroscopy of the mitochondria supported the enzymatic data by indicating the presence of metals known to be involved in the aerobic reactions of the Krebs cycle. Glycolate was oxidized by the peanut mitochondria, and the rate was increased by small amounts of $MgCl_2$. No phosphorylation accompanied this oxidation. Both mitochondrial and microsomal fractions decarboxylated palmitic-1-C^{14} acid.

Phosphorylation accompanying succinate and α-ketoglutarate oxidation, as indicated both by a disappearance of inorganic phosphate and by the synthesis of P^{32}-labeled adenosine triphosphate, was dependent upon added adenosine diphosphate. The synthesis of glucose-6-phosphate and three unidentified compounds accompanied the phosphorylation. A P^{32}-labeled substance tentatively identified as galactose phosphate was formed when galactose and microsome-free supernatant were added to mitochondria oxidizing α-ketoglutarate.

The P:O ratio, as determined by the ratio of micromoles of phosphate disappearing to the microatoms of oxygen taken up, approached 1.0 in the oxidation of pyruvate, citrate, succinate, malate, and ferrocytochrome c, and 2.0 in the oxidation of α-ketoglutarate. These values were not improved by varying the method of mitochondrial preparation, the homogenizing solution, or the concentrations of the required cofactors.

Evidence was presented which indicated that the phosphorylations occurring in the oxidation of the above substrates were localized at two sites, one in the region between cytochrome c and oxygen in the electron transport system, and the other at the substrate level in the oxidation of α-ketoglutarate. These data indicated that the P:O ratio approaching 2.0 involved both phosphorylation sites, while the single phosphorylation occurring for the other substrates was confined to the cytochrome c ⟶ oxygen step of electron transport.

159 pages. $2.10. Mic 57-3032

LIPIDS OF THE CHINOOK SALMON (ONCORHYNCHUS TSCHAWYSTSCHA, WALBAUM)

(Publication No. 22,175)

Gilles Joseph Regent La Roche, Ph.D.
University of Washington, 1957

A new method for the quantitative separation of ether-extractable lipids into their components is described and discussed. Lipids of the liver, the spent ovary and the ripe ovary were thus separated. Quantitative estimations of sterol esters, free-sterol, triglycerides, phosphatidyl ethanolamine and serine, inositides, lecithins, sphingolipids and groups of unknowns are presented for these three tissues.

Cholesterol has been demonstrated as the main liver sterol. Its structural identity has been obtained by chemical proof. Liver lecithins have been investigated and their probable structure is discussed.

An analogy is drawn between the lipids of actively metabolizing tissues and those of storage tissues.

79 pages. $2.00. Mic 57-3033

A STUDY OF FREE AMINOACIDS IN THE HUMAN CEREBROSPINAL FLUID

(Publication No. 22,484)

John A. Logothetis, Ph.D.
University of Minnesota, 1957

The study of the cerebrospinal fluid constituents has clearly proven helpful in the diagnosis of central nervous system disease. However, the free aminoacid content of this biological fluid has not been adequately investigated. Such study may be revealing in disease of the nervous system, and so aid in the diagnosis of obscure disorders. This study deals with the quantitative analysis of free aminoacids in health and disease. Two-dimentional chromatography and direct photometry are used, utilizing 1 ml of spinal fluid for each chromatogram. In order to avoid the time consuming spotting of the fluid on the filter paper, an automatic apparatus was developed which can accommodate several papers simultaneously. The desalting of the specimens is carried out in a five unit desalter representing a modification of the single unit apparatus of Consden. The solvents used for the development of the chromatogram are water saturated phenol, and 2,6 lutidine in mixture with ethanol and water. The detection of the aminoacids on the developed chromatogram is carried out by dipping the papers in 0.1 mg% ninhydrin and drying for 18 hours at room temperature. For the estimation of the amount of the aminoacids on the chromatogram, maximum color density of each spot is first determined by means of a densitometer, and then the corresponding amount of the aminoacid concerned is determined by making use of prepared calibration curves. The calibration curves for 20 aminoacids were prepared by running 25 replicate analyses of an aminoacid mixture at each of 1, 2, 4, 6, and 8 millimolar concentrations.

The analysis of fifty-two cerebrospinal fluid specimens obtained from subjects free of neuropsychiatric disorder and systemic disease, has permitted the identification and quantitation of seventeen aminoacids including: aspartic acid, alanine, asparagine, arginine, a-aminobutyric acid, glycine, glutamic acid, glutamine γ-aminobutyric acid, lysine, leucine, phenylalanine, proline, serine, threonine, tyrosine, and valine. The mean values of these aminoacids range between 0.4 and 2 mg%. In addition to the above aminoacids, histidine and cystine were identified in few samples obtained from patients with neurological diseases.

The analysis of nearly two-hundred samples of spinal fluid from patients with neurological and psychiatric disorders, has revealed consistent significant alterations in some free aminoacids in multiple sclerosis (decrease in alanine and valine), hereditary cerebellar ataxia (increase in alanine, aspartic acid, glycine, lysine, serine, and threonine), and brain atrophy (decrease in alanine, aspartic acid, valine, serine, and leucine.)

The total quantitative error involved is about 16% if duplicate spinal fluid analyses are carried out in each case.

In conclusion two-dimensional chromatography and direct photometry were utilized effectively in the study of spinal fluid free aminoacids. The developed automatic spotting apparatus and modified electrodesalter, allow for rapid processing of the samples. Apparently not all biologically important aminoacids can be identified in free form in the cerebrospinal fluid. The few specific changes found in central nervous system diseases offer encouragement for future research in this field.

160 pages. $2.10. Mic 57-3034

A STUDY OF THE ROLES OF UNIVALENT CATIONS IN THE METABOLISM OF HIGHER PLANTS

(Publication No. 21,897)

Gene Walker Miller, Ph.D.
North Carolina State College, 1957

Supervisor: Harold J. Evans

The objectives of this investigation were to elucidate as far as possible the metabolic roles of univalent cations in higher plants, and determine the extent to which any one univalent cation would replace another in isolated biological systems.

The literature indicating the influence of univalent cations on enzyme systems from microorganisms and animal and plant tissues has been reviewed. From this it was observed that cytochrome oxidase, pyruvate kinase, hexokinase, oxalosuccinate decarboxylase, malic dehydrogenase, enzymes involved in peptide bond synthesis, transacetylase reactions, aldehyde dehydrogenase and enzymes involved in oxidative phosphorylation were strikingly influenced by univalent cations. The concentrations of cations necessary for optimum activity were of the order of magnitude of the univalent cation concentrations in fresh plant tissue. The cation requirements of the reviewed systems, for the most part, had not been investigated in higher plants. In this manuscript thorough studies have been conducted on the cation requirements of cytochrome oxidase and pyruvate kinase from higher plants.

Studies with cytochrome oxidase from roots of soybean, tobacco, spinach and oats have shown that both divalent and

univalent cation salts have a striking effect on enzyme activity. When the anions were held constant as chlorides and the effect of cations compared on an equivalent basis, increasing of univalent cation salt concentrations gave maximum stimulation at about 0.12 N. Chloride salts of Na^+, K^+, NH_4^+, or Li^+ were found to be equally effective as activators and mixtures of these salts gave stimulation comparable to the single salts. Chloride salts of divalent cations were less stimulatory than the univalent salts. Maximum activity was obtained at 0.05 N. and higher concentrations were inhibitory. Enzyme activity was stimulated over and above the cation effect in the presence of phosphate salts, and inhibited in the presence of bicarbonate salts. Assays with solubilized cytochrome oxidase showed no stimulatory effect of salts.

Experiments were conducted to determine the properties and specifically the cation requirements of pyruvate kinase. The concentrations of ADP and PEPA required for the saturation of the enzyme from pea seed were determined. Detailed studies with pyruvate kinase from pea seed demonstrated an absolute requirement for divalent cations such as Mg^{++}, Mn^{++}, or Co^{++}. A requirement was also established for univalent cations. Potassium ions gave highest stimulation followed in decreasing order of magnitude by Rb^+, NH_4^+ and Na^+. The enzyme activity was essentially independent of the anion present with the exception of Br^- and I^- which were slightly inhibitory at concentrations greater than 0.05 N. Pyruvate kinase activity was demonstrated in the extracts of the seeds of wheat, cotton, oat, corn and beet; and in the leaves of tobacco and peas and in the petioles of celery. An absolute requirement for univalent cations was demonstrated with extracts of cotton, oat and corn seed.

The roles of univalent cations in higher plant metabolism are presented from the standpoint of the investigations reported in this manuscript, and postulations are formed as to why K^+ is indispensable in plant growth.

94 pages. $2.00. Mic 57-3035

THE EFFECT OF ASCORBIC ACID ON THE INACTIVATION OF TYROSINASE DURING THE AEROBIC OXIDATION OF CATECHOL

(Publication No. 22,063)

Walter Scharf, Ph.D.
Columbia University, 1957

Tyrosinase is an enzyme widely distributed in nature and possessing the ability to catalyze the aerobic oxidation of both monophenols and o-diphenols to their corresponding o-quinones.

The o-diphenolase or "catecholase" activity is characterized by early and progressive inactivation as the oxidation proceeds. Attempts to account for this phenomenon (often termed "reaction-inactivation" to distinguish it from inactivation via denaturation) by assigning an inhibitory role to one or several of the components in the reaction-mixture have, thus far, met with failure.

Recent reports that, under certain conditions, inactivation of tyrosinase can be reversed by ascorbic acid were examined and found to be illusory.

o-Benzoquinone, the initial oxidation product of the enzymatic reaction, is a reddish-brown compound having a characteristic absorption maximum at 390 mu. Because it is unstable in aqueous solution and so disappears from the reaction-mixture soon after it is formed, a steady-state of quinone concentration is eventually set up in the system. This causes the absorbance (O.D.) of the solution to remain constant in time even though o-benzoquinone is continually being produced by enzyme action.

Workers who use the rate of color development in the solution as a measure of enzyme activity can easily mistake this constancy of the O.D. during the steady-state period for cessation of quinone production and hence for enzyme inactivation.

The authenticity of the steady-state, and therefore the presence in the solution of active enzyme at a time when it was presumed to be dead, was demonstrated by showing that the O.D. can be raised or lowered during this period according as changes which either favor or hinder the enzymatic reaction are brought about.

Since O.D. measurements are usually made in a narrow spectrophotometer cell providing but a small air-liquid interface, the oxygen supply of the solution is rapidly depleted by the enzymatic reaction under study. This exhaustion of one of the substrates brings the reaction to a premature halt and can lead the superficial observer to erroneous conclusions regarding enzyme inactivation. If ascorbic acid be now added to the system, spurious reactivation effects are observed because the solution was inadvertently aerated during the mixing process. Errors due to this source were eliminated by use of a specially designed spectrophotometer cell which allows continuous bubbling of oxygen through the solution while O.D. readings are taken.

The inability of ascorbic acid, per se, to either activate functioning enzyme or to reactivate truly spent enzyme was also established in the course of this work.

These findings not only support the contention that early inactivating of the enzyme in the solution is a process independent of reaction products and inherent in the catalytic mechanism, but also reinstate the validity of the Chronometric (ascorbic acid-titration) Method for measuring catecholase activity. 78 pages. $2.00. Mic 57-3036

STRUCTURAL STUDIES ON GLUCOMANNANS

(Publication No. 22,497)

Harish C. Srivastava, Ph.D.
University of Minnesota, 1956

Part I. The glucomannan of Iles Mannan, the polysaccharide extracted from the tubers of Amorphophallus plants (family Araceae) gives on acetolysis with acetic anhydride and sulfuric acid a mixture of mono- and oligosaccharide acetates. Saponification of these acetates and separation of the mixture of sugars on columns of charcoal and cellulose affords glucose, mannose and a number of oligosaccharides, three of which have been crystallized and identified as 4-O-β-D-glucopyranosyl-α-D-mannopyranose, 4-O-β-D-glucopyranosyl-D-glucopyranose (cellobiose) and 4-O-β-D-mannopyranosyl-α-D-glucopyranose. The last named disaccharide is new and its structure has been proved by converting it into the fully methylated

derivative and identifying 2,3,4,6-tetra-O-methyl-D-mannose and 2,3,6-tri-O-methyl-D-glucopyranose as the cleavage products of the disaccharide methyl ether.

The structural pattern of the glucomannan polysaccharide is discussed in the light of the methylation and degradative studies.

Part II. The bulbs of Amorphophallus konjak C. Koch (syn. Conophallus konjak Schott) are the source of the "konjak flour" which is used as an article of food in Japan. The glucomannan component of the konjak flour is isolated by precipitating it as a copper complex followed by the decomposition of the latter with acid. The glucomannan is obtained as a white granular powder, $[\alpha]_D^{23}$ -38° in 20 per cent sodium hydroxide. Upon hydrolysis it gives glucose and mannose in the proportions of 2:3.

Methylation of the konjak glucomannan first with methyl sulfate and alkali and then with methyl iodide and silver oxide affords a fully methylated glucomannan, $[\alpha]_D$ -19° ($CHCl_3$); OCH_3, 44.0. The methylated polysaccharide gives, upon methanolysis followed by hydrolysis, a mixture of 2,3,4,6-tetra-O-methyl-D-glucose, 2,3,4,6-tetra-O-methyl-D-mannose (1.0 mole), 2,3,6-tri-O-methyl-D-glucose, 2,3,6-tri-O-methyl-D-mannose (11 moles), 2,6-di-O-methyl-D-glucose and 2,6-di-O-methyl-D-mannose (0.9 mole). The methylated sugars were separated on a cellulose-hydrocellulose column and identified (where possible) by converting them into characteristic crystalline derivatives.

Upon oxidation of the glucomannan with sodium periodate, date, 1 mole of formic acid is produced for every 10 anhydro hexose units and 1 mole of periodate is consumed per anhydro hexose unit. When the periodate oxidized glucomannan is reduced to the corresponding polyalcohol and the latter hydrolyzed, it affords glycerol, erythritol, mannose and glucose, a result to be expected from the methylation data.

The results of methylation and periodate oxidation of the konjak glucomannan are discussed with regard to the structural pattern of the polysaccharide.

86 pages. $2.00. Mic 57-3037

CHEMISTRY, INORGANIC

STUDIES ON HALOGEN AND POLYHALOGEN COMPLEXES

(Publication No. 22,076)

William Arna Deskin, Ph.D.
State University of Iowa, 1957

Chairman: Assistant Professor Alexander I. Popov

Halogen and interhalogen compounds are known to form complexes with electron donor types of molecules. This is a Lewis acid-base type of interaction, in which the halogens or the interhalogen compounds are the electron acceptors. If the donor is a halide ion, a polyhalide ion is formed; while if the donor is a neutral molecule, such as acetonitrile, a molecular complex is formed.

In the present investigation, it has been shown that iodine halides form 1:1 complexes with acetonitrile when these substances are dissolved in carbon tetrachloride. The Benesi and Hildebrand method for the study of molecular complexes has been applied to spectrophotometric data obtained from solutions of iodine monochloride, iodine monobromide and iodine, complexed with acetonitrile, in carbon tetrachloride. The formation constants, K_c (lit. $mole^{-1}$), were found to be 6.9, 1.40 and 0.57 for ICl, IBr and I_2 complexes, respectively. This order of acid strength follows the same order as has previously been reported with other types of donors, such as benzene, etc.

When iodine monochloride is dissolved in acetonitrile, it has been shown that after the complex is formed, a slow ionization occurs. This reaction may be followed by an increase in an absorption maximum at 227 mμ, as well as by an increase in the electrical conductance. The ions formed when the complex dissociates are the iododichloride ion and probably the solvated iodonium ion. It has been shown that other types of reactions, such as halogenation of the solvent and/or of an impurity would not account for the observed changes in absorption or conductance.

Iodine monochloride has been studied in several nonaqueous solvents, namely, acetonitrile, carbon tetrachloride, benzene and normal hexane. It has been shown that solutions in normal hexane are not stable and that a reaction occurs with the liberation of free iodine, and, probably, a chlorinated hydrocarbon. This reaction was followed by an iodometric titration for total halogen remaining after definite periods of time, as well as by spectrophotometric measurements in the ultraviolet and infrared portions of the spectrum. The chlorinated product could not be definitely identified; however, evidence for its presence was obtained from the infrared spectra of the solutions which show a carbon-chlorine absorption band.

Infrared spectra were obtained from solutions of iodine monochloride with the above solvents and some interesting observations were noted. The absorption of iodine monochloride vapor has previously been reported to have a peak at 381 $cm.^{-1}$. In some preliminary work this fundamental band was found to be shifted to 345 $cm.^{-1}$ for solutions in benzene. The hexane solutions showed a weak band at 375 $cm.^{-1}$ which indicates a loss of iodine monochloride and confirms the instability of these solutions. Perhaps the most interesting observation was that of a doublet structure occurring in the carbon tetrachloride solution, which indicated some interaction in this supposedly "ideal" solution. The absorption peak was observed at 375 $cm.^{-1}$ with the shoulder at 368 $cm.^{-1}$. The acetonitrile solutions were complicated by the presence of a rather strong band at 380 $cm.^{-1}$ due to the solvent. If a proper correction was made for the absorption of the solvent then a band was observed at 385 $cm.^{-1}$. This indicates only a very slight shift from the value of 381 $cm.^{-1}$ reported for the iodine monochloride vapor. The intensity of this fundamental vibration is roughly the same in acetonitrile as in carbon tetrachloride, indicating little effect on the dipole moment change during this vibration due to the complex-formation.

92 pages. $2.00. Mic 57-3038

THE REACTION BETWEEN MOLYBDENUM AND TOLUENE-3,4-DITHIOL

(Publication No. 22,489)

Theodore William Gilbert Jr., Ph.D.
University of Minnesota, 1956

Major Adviser: E. T. Sanders

The object of this investigation was to study the reaction of molybdenum (VI, V, IV, III) with toluene-3,4-dithiol, with special reference to the reaction products.

Dithiol is insoluble in aqueous media and behaves as a dibasic acid. Its first dissociation constant is 4×10^{-6} as determined by its titration with base in alcohol-water mixtures and extrapolation of the results to aqueous solution. The second dissociation is exceedingly weak.

The reaction of dithiol with molybdenum (VI) in sulfuric acid is slow at room temperature, but equilibrium is rapidly attained when the solutions are heated. When the reagent dissolved in dilute sodium hydroxide is added to the strongly acid solution, it precipitates, giving a fine suspension. Reaction then occurs between the precipitated dithiol and molybdenum and an insoluble molybdenum-dithiol compound is formed. This compound is soluble in organic solvents giving an intense green color. Benzene was preferred as solvent. Because of its very low solubility in the aqueous phase and its high solubility in benzene, the green complex is quantitatively extracted with one portion of benzene.

The green molybdenum-dithiol complex was isolated in the solid state and its elemental composition determined. Three dithiol molecules are combined with one molybdenum atom in the complex. Application of the method of continuous variations and the method of linear addition also indicated the formation of a three to one complex. Measurements of the magnetic susceptibility of the solid compound confirmed chemical evidence that the molybdenum in the complex is in the +6 oxidation state.

No reaction is observed between molybdenum (III) and dithiol. Because salts of molybdenum (IV) are unstable in aqueous solution, a direct reaction of molybdenum (IV) with dithiol was not possible. The complex ion, $Mo(CN)_8^{-4}$, would not react with dithiol at room temperature.

Molybdenum (V) reacts with dithiol to yield two products. One of these is the green complex formed in the reaction with molybdenum (VI), and the other is a reddish brown compound. They are readily separable by crystallization or by chromatographic adsorption on alumina. Once isolated, the latter compound can be obtained in the solid state. It also contains three dithiol groups per molybdenum.

When molybdenum (V) reacts with dithiol, it disproportionates to give a complex of molybdenum (VI) and another complex of molybdenum (IV). Some direct reduction of molybdenum (V) to molybdenum (IV) occurs also. The ratio of the amounts of molybdenum (VI) and molybdenum (IV) complexes produced is a function of the acidity of the solution, and in strongly acid solutions the reaction of molybdenum (V) with dithiol is not quantitative even in the presence of a large excess of dithiol. An explanation of these observations is suggested.

The voltammetric behavior of the molybdenum complexes in dimethylformamide was also investigated.

156 pages. $2.05. Mic 57-3039

CATION SUBSTITUTIONS IN FERRIMAGNETIC OXIDES

(Publication No. 22,659)

Arthur H. Mones, Ph.D.
Polytechnic Institute of Brooklyn, 1957

Adviser: Professor Ephraim Banks

The work of Gorter, Maxwell and Pickart and others showed that the substitution of non-magnetic cations for Fe^{III} or other magnetic ions in the cubic spinels produced magnetic effects in agreement with Neel's hypothesis of ferrimagnetism. When the non-magnetic cations substituted in spinels, preferentially occupy either the available tetrahedral or octahedral lattice sites vacated by Fe^{III}, alterations in the magnetic intensity occur, beyond what might be expected from mere dilution effects. In the spinels preferential substitutions of cations in the tetrahedral sites increase the magnetic moment of the compound over a limited range of composition. This increase has been noted with substitution of ions like Zn^{II} or Ga^{III}. Conversely ions which show preference for octahedral coordination, e.g., Al^{III} and Cr^{III} tend to decrease the magnetic moment of ferrimagnetic oxides.

The substitution of cations with zero magnetic moment for Fe^{III} in the hexagonal ferrimagnetic oxide, $BaFe_{12}O_{19}$, was attempted to determine whether these substitutions would produce effects similar to those observed in the ferrimagnetic spinel oxides, e.g., $NiFe_2O_4$. The nature of the substitution of non-magnetic cations in $BaFe_{12}O_{19}$ is more complicated than in the spinels since in the former there are 5 nonequivalent lattice sites as compared to only two, the tetrahedral and octahedral, in the spinel.

A series of compounds of the type $BaFe^{III}_{12-x}Me^{III}_xO_{19}$ was prepared at 1350° C.; their magnetic and structural properties were extensively investigated. Single crystals of members of this series were prepared from a Na_2CO_3 flux at 1350° C. Compounds were not prepared with $x > 8$.

From the magnetic data it was concluded that Al^{III} substituted preferentially in octahedral sites in the spinel blocks in the structure and Ga^{III} over a very limited composition range in the tetrahedral sites in the spinel blocks.

Zn^{II} substitution produced a significant increase in magnetic moment, indicating, perhaps, a stronger preference for the tetrahedral site than Ga^{III}. The substitution of other ions with octahedral preference, e.g., Cr^{III}, Mg^{II} and Ti^{IV} decreased the moment of the compound as compared to the parent compound, $BaFe_{12}O_{19}$, in accord with the assumption of octahedral substitution.

Magnetic saturation moments were obtained from single crystals of the Ga^{III} and Al^{III} series. These materials are magnetically anisotropic with a strong preferential direction of magnetization along the crystallographic c axis. Magnetic measurements perpendicular to this axis showed that the anisotropy constant of the Ga^{III} and Al^{III} substituted compounds was essentially the same as that of $BaFe_{12}O_{19}$, i.e., $\sim 3 \times 10^6$ ergs/cm.^{3}. It was not possible to obtain magnetic saturation data for the polycrystalline samples.

Attempts to prepare compounds analogous to $Na_{\frac{1}{2}}La_{\frac{1}{2}}Fe_{12}O_{19}$ by substituting the trivalent rare earth ions, Pr^{III}, Nd^{III}, Sm^{III} and Gd^{III} for La^{III} were unsuccessful. X-ray diffraction data showed that large excesses of Fe_2O_3 was present in the preparation. There was some indication

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that the desired compound was also formed. Precise magnetic measurements were not made on these impure materials.

A new series of magnetic oxides were prepared from solid solutions of Na_2O, ZnO and Fe_2O_3. These compounds could be thought of as solid solutions of the hypothetical $Na_{0.5}Fe_{2.5}O_4$ and $ZnFe_2O_4$, although most of the compositions deviated slightly from solid solutions of this type.

The compounds crystallize in the spinel structure. The observed magnetic moments were consistent with the assumption that Zn^{II} occupied the tetrahedral and Na^{I} the octahedral site exclusively, with Fe^{III} occupying the remaining available sites.

The range of strong magnetic compositions were found in a small composition range.

Analogs were prepared in this series where Na^{I} or Zn^{II} were replaced by other ions, e.g., K^{I} for Na^{I} and Mg^{II} for Zn^{II}. When potassium was substituted for sodium the magnetic activity disappeared. The Mg^{II} compound was strongly magnetic. 149 pages. $2.00. Mic 57-3040

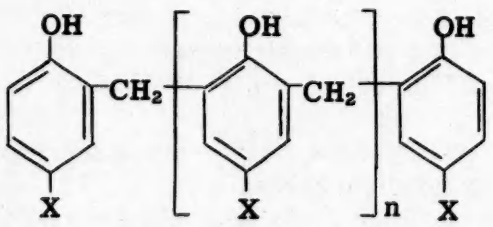
LINEAR PHENOL-FORMALDEHYDE POLYMERS FROM o- AND p-CHLOROPHENOL

(Publication No. 21,686)

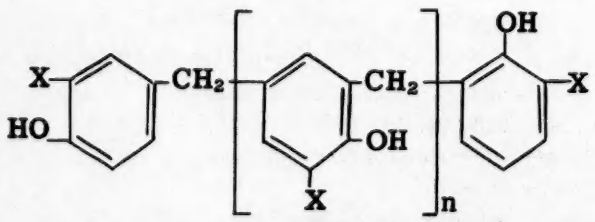
Sven Helmuth Ruetman, Ph.D.
University of Utah, 1957

Chairman: W. J. Burke

High molecular weight, acetone soluble polymers (Ia and IIa) were prepared by the condensation of p- and o-chlorophenol with s-trioxane in bis-(2-ethoxyethyl) ether and in the presence of p-toluenesulfonic acid as catalyst. Dehalogenation of resulting products with sodium in liquid ammonia led to the corresponding linear phenol-formaldehyde polymers (Ib and IIb).



Ia: X = -Cl
Ib: X = -H



IIa: X = -Cl
IIb: X = -H

Three independent routes were used to prepare p-chlorophenol-formaldehyde polymers (Ia): (1) direct condensation of p-chlorophenol with formaldehyde, (2) reaction of 2,6-bis-(hydroxymethyl)-4-chlorophenol with p-chlorophenol; and (3) polymerization of 4-chloro-2-hydroxymethylphenol.

Condensation of o-chlorophenol and bis-(3-chloro-4-hydroxyphenyl)-methane (dimer) with formaldehyde were used to obtain o-chlorophenol-formaldehyde polymers (IIa). Direct condensation of o-chlorophenol with formaldehyde would be expected to give a random distribution of methylene linkages between the available ortho and para positions. Since the dimer has no free para positions, this compound was used as a route to polymers having a regular recurrence of ortho-ortho-para-para linkages between phenolic nuclei. Infrared absorption spectra, however, did not reveal any significant difference between the two types of polymers.

Reaction variables studied in the synthesis of polymers from p- and o-chlorophenol (Ia and IIa) included temperature, time, solvent, catalyst, and ratio of reactants. Under comparable reaction conditions, higher molecular weight products were obtained with p-chlorophenol than with o-chlorophenol. In both series formaldehyde in excess of equimolar proportions favored higher molecular weight products, while an excess of the phenol produced the opposite effect. The relative quantities of solvent in the condensation of equimolar amounts of p- or o-chlorophenol with formaldehyde proved to be a highly important factor in controlling both the degree of polymerization and the solubility of the polymers. Higher concentrations of reactants were favorable to a greater degree of polymerization but use of too little solvent resulted in only partially soluble products. Temperature in excess of 150°C. and an increase of reaction time from 24 to 48 hours were favorable to products with higher intrinsic viscosity with p-chlorophenol but not with o-chlorophenol.

The p- and o-chlorophenol-formaldehyde polymers (Ia and IIa) were characterized by the preparation of acetyl derivatives, fractionation studies, cryoscopic molecular weight determinations, elemental analyses, and infrared absorption spectra. All of these supported the proposed linear structure for the polymers from p-chlorophenol (Ia) and o-chlorophenol (IIa).

p-Chlorophenol-formaldehyde polymers (Ia) were easily dehalogenated with sodium in liquid ammonia to the corresponding phenol-formaldehyde polymers (Ib). The low solubility of o-chlorophenol-formaldehyde polymers (IIa) in liquid ammonia, however, necessitated the addition of tetrahydrofuran to the dehalogenation system in order to effect complete removal of chlorine.

The linear phenol-formaldehyde polymers from p- and o-chlorophenol (Ib and IIb) were characterized by acetyl derivatives, elemental analyses, and infrared absorption spectra.

The phenol-formaldehyde polymer (Ib) was much more readily cross-linked with hexamethylenetetramine than was the polymer (IIb). 86 pages. $2.00. Mic 57-3041

CHEMISTRY, ORGANIC

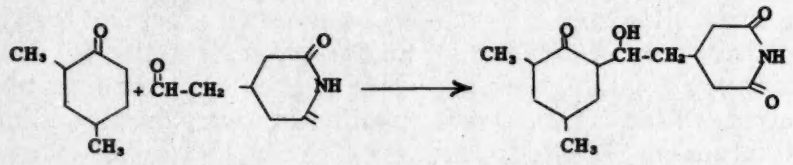
ACTIDIONE. THE SYNTHESIS OF THE GLUTARIMIDE MOIETY.

(Publication No. 22,191)

Mario Adam Acitelli, Ph.D.
Cornell University, 1957

The antifungal antibiotic, actidione, was first isolated from Streptomyces griseus beers in 1946. Several years later its chemical structure was found to be β-[2-(3,5-dimethyl-2-oxocyclohexcy)-2-hydroxyethyl] -glutarimide (I), but this assignment has not been verified by total synthesis.

This latter problem was approached with the view that actidione would result from an aldol condensation between 2,4-dimethylcyclohexanone (III) and glutarimide β-acetaldehyde (VIII), and it has been the object of this thesis research to prepare these two compounds.



III VIII I

The synthesis of 2,4-dimethylcyclohexanone (III) was accomplished by the catalytic reduction of 2,4-dimethylphenol followed by oxidation of the resulting cyclohexanol derivative. Since the preparation of a suitable resolving agent for the racemic mixture failed, the correct isomer was obtained directly from the hydrolysis of actidione.

A variety of routes to glutarimide β-acetaldehyde (VIII) was explored. The method which finally succeeded involved citric acid as a starting material, from which methyl β-ketoglutarate could be obtained in good yield. This ester was hydrogenated to the corresponding alcohol, methyl β-hydroxyglutarate, which then was dehydrated to methyl glutaconate. A Michael addition of methyl cyanoacetate to methyl glutaconate gave trimethyl α-cyanomethanetriacetate. The partial hydrolysis of this cyanotriester followed by decarboxylation and cyclization afforded satisfactory yields of glutarimide β-acetic acid. The conversion of this acid to the desired aldehyde (VIII) was accomplished by the Rosenmund reduction of the corresponding acid chloride.

Several attempts to condense the aldehyde (VIII) and (+) 2,4-dimethylcyclohexanone have been made but crystalline material has not been obtained. However, the successful synthesis of the aldehyde (VIII) has now made possible a thorough investigation of this reaction.

64 pages. $2.00. Mic 57-3042

I. REDUCTION OF AROMATIC COMPOUNDS CONTAINING FUNCTIONAL GROUPS WITH LITHIUM IN LOW MOLECULAR WEIGHT AMINES. II. COMPARISON OF THE SODIUM-AMMONIA AND LITHIUM-AMINE SYSTEMS.

(Publication No. 21,267)

Charles Arnold, Jr., Ph.D.
Purdue University, 1957

Major Professor: Dr. Robert A. Benkeser

I. Reduction of Aromatic Compounds Containing Functional Groups with Lithium in Low Boiling Amines.

Representative types of substituted aromatic compounds have been subjected to reduction by lithium in methyl and ethylamine. Compounds containing reducible functional groups like olefins and ketones are reduced in this system to saturated hydrocarbon chains and alcohols. In most instances the aromatic nucleus is concomitantly reduced to a monoolefin. Thus, styrene is reduced to a mixture of 1-ethylcyclohexene and ethylcyclohexane, acetophenone is reduced to 1-(1-cyclohexenyl)-ethanol and phenylacetone is reduced to 1-(1-cyclohexenyl)-2-propanol.

Ketals structurally similar to allylic ethers undergo cleavage during reduction, whereas ketals, which are sufficiently far removed from the aromatic ring, are stable under the conditions employed. Thus acetophenone diethyl ketal is reduced to 1-ethylcyclohexene, while benzylacetone diethyl ketal undergoes reduction to give 4-(1-cyclohexenyl)-2-butanone after acid hydrolysis.

The reduction of tertiary aromatic amines leads to a relatively high yield of the completely saturated product. Thus, N,N-dimethylcyclohexylamine is obtained in 37% yield from the reduction of N,N-dimethylaniline. The theoretical implication of this result is discussed.

The reduction of aromatic monocarboxylic acids proceeds abnormally in that unconjugated diolefinic acids are obtained instead of the expected monoolefin. Thus, upon reduction of benzoic, ortho-toluic and phenylacetic acids, 1,4-dihydrobenzoic, 2-methyl-1,4-dihydrobenzoic and 2,5-dihydrophenylacetic acids are obtained, respectively. The orientation of the unconjugated double bonds is governed by the electrical effects of the substituents attached to the aromatic ring.

During the reduction of p-anisic acid the methoxy group was eliminated to give 1,4 dihydrobenzoic acid. The methoxy group of m-anisic acid, however, was obtained during the reduction, and 3-carboxycyclohexenone was obtained after acid hydrolysis.

The reduction of phthalic anhydride and N-methylphthalamic acid gives rise to trans-$\Delta^{3 \text{ or } 5}$-N-methyltetrahydrophthalamic acid, an unconjugated monoolefin.

The anomalous behavior of aromatic acids and acid derivatives in the lithium-amine system is discussed.

II. Comparison of the Sodium-Ammonia and Lithium-Amine Reducing Systems.

Alkali metal ammonia reducing systems could not be induced to effect the reduction of benzenoid aromatics by; 1) introduction of a substituted amide (for isomerization of the 1,4-dihydro intermediate); 2) raising the reaction temperature and prolonging the reaction time. Attempts to bring about the reduction of aromatic nucleii with a "lithium methylamine complex" met with failure.

167 pages. $2.20. Mic 57-3043

ELECTROREDUCTION OF DIPHENYLIODONIUM SALTS

(Publication No. 22,651)

H. Elizabeth Bachofner, Ph.D.
Polytechnic Institute of Brooklyn, 1957

Adviser: F. Marshall Beringer

The electroreduction of diphenyliodonium salts has been investigated both by polarography at the dropping mercury electrode and by coulometry at controlled potential. The three polarographic waves are shown to correspond to the following processes:

$$\text{(I)}\quad \overset{+}{\dot{R}}IR + \underline{e} \rightleftharpoons \dot{R}IR$$

$$\text{(II)}\quad \dot{R}IR + \underline{e} + H^+ \longrightarrow RH + RI$$

$$\text{(III)}\quad RI + 2\underline{e} \longrightarrow R^- + I^- \quad \text{(slow)}$$

$$R^- + H^+ \longrightarrow RH \quad \text{(fast)}$$

The nature of the anion influences the electroreduction only when it is reduced or oxidized at the dropping mercury electrode at a potential close to that of one of the waves of the iodonium cation.

The polarogram always has the same appearance, whether the supporting electrolyte is buffered, unbuffered, aqueous or 50% ethanolic. At constant ionic strength, variation of pH between 2.2 and 8.0 does not change the half-wave potential of waves I and III, but shifts that of wave II to more negative values as pH increases. At constant pH, increasing ionic strength shifts the half-wave potential of wave I to more negative values, that of wave III to less negative values and has no influence on that of wave II.

With the unsubstituted diphenyliodonium cation, the relation of half-wave potential to concentration changes abruptly at 1 mM and again at 8-10 mM. Bulky aliphatic substituents lead to adsorption of the diphenyliodine (the product of reduction at wave I) on the surface of the mercury drop. Other substituents have little or no effect on the half-wave potentials of waves I and II. However, wave III is shifted to more negative values when electron-donating substituents are present and to less negative potentials when electron-withdrawing substituents are present.

The response of wave II of the 4,4'-di-tert-butyldiphenyliodonium cation to changing mercury pressure has suggested that the diaryliodine free radicals ($R\dot{I}R$) are in rapid, reversible equilibrium with a substituted iodobenzene and a substituted phenyl free radical. Diphenyliodine produced

$$RIR \longrightarrow RI + R\cdot$$

by controlled potential electrolysis has only a short existence, decomposing to iodobenzene and other products.

Comparison of the polarographic reduction of the 2,2'-dithienyldiphenyliodonium cation with the diphenyliodonium cation shows that reduction of the former occurs much more readily at all three stages. On the other hand, linking the 2,2'-positions of the diphenyliodonium cation with a methylene ($-CH_2-$) or a trimethylene ($-CH_2CH_2CH_2-$) bridge has little effect on the reduction.

68 pages. $2.00. Mic 57-3044

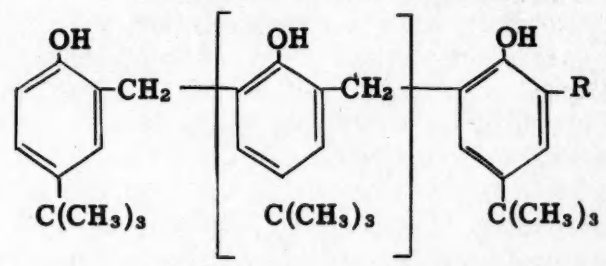
POLYMERIZATION OF 2-SUBSTITUTED-AMINOMETHYLPHENOLS

(Publication No. 22,144)

Bruce Arlyn Barton, Ph.D.
University of Utah, 1957

Chairman: W. J. Burke

Polymerization of 4-t-butyl-2-cyclohexylaminomethylphenol yielded a bright yellow solid, cyclohexylamine, 4-t-butylphenol and an insoluble white compound, tentatively identified as the cyclic tetramer of 4-t-butylphenol and formaldehyde. The results of elemental analyses, chemical studies, molecular weight determinations, and infrared absorption spectra on the yellow solid were consistent with those required for a series of closely related polymers differing only in end groups and having the following structure:



where R is CH_3, H, or $CH{=}NC_6H_{11}$ and n has an average value of seven.

Acid hydrolysis of the yellow product occurred readily with the formation of a white polymer. The amount of cyclohexylamine hydrochloride isolated from the hydrolysis mixture was equivalent to about one anil end group per two polymer chains. Reactions of the hydrolyzed polymer with cyclohexylamine yielded a yellow product having an infrared spectrum and molecular weight essentially identical with that of the original polymer.

Acetylation of the hydrolyzed polymer in the presence of perchloric acid gave a derivative which analyzed for one salicylidene triacetate end group for every other polymer chain. The hydrolyzed polymer reacted with aniline to give an orange product, the infrared spectrum of which was consistent with the presence of a conjugated anil end group. Reduction of the hydrolyzed polymer with lithium aluminum hydride resulted in the conversion of the aldehyde end groups into methylol radicals. Upon heating the reduced product with an acid catalyst a polymer with a higher molecular weight was obtained.

Reduction of the original yellow polymer with lithium aluminum hydride yielded a colorless product which did not show the characteristic infrared band for an anil (6.10 microns). Acetyl analysis on the acetylated reduced polymer was consistent with one N-acetyl group per two polymer chains. The reduced polymer, upon heating resulted in a product with a higher degree of polymerization.

Polymerization of the previously undescribed N,N-bis (5-t-butyl-2-hydroxybenzyl)cyclohexylamine; condensation of bis(5-t-butyl-2-hydroxybenzyl)methane with 1,3,5-tricyclohexylhexahydro-1,3,5-triazine; and condensation of 2,6-bis(cyclohexylaminomethyl)-4-t-butylphenol with p-t-butylphenol gave in each instance a bright yellow polymer. The physical and chemical properties of these products

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

indicated a close similarity to the polymer from 4-t-butyl-2-cyclohexylaminomethylphenol.

Polymers of the same general type were prepared from 2-t-butylaminomethyl-4-t-butylphenol, 4-t-butyl-2-t-octylaminomethylphenol and 2-benzylaminomethyl-4-t-butylphenol. The three monomers were new compounds.

Related polymers, without terminal anil groups, resulted from the polymerization of 4-t-butyl-2-dimethylaminomethylphenol and from the condensation of 4-t-butylphenol with formaldehyde.

The following models were prepared to assist in the characterization of the above polymers by infrared spectral data: 5-t-butyl-3-methylsalicylaldehyde, N-(5-t-butyl-2-hydroxy-3-methylbenzylidene)-cyclohexylamine and N-(5-t-butyl-2-hydroxy-3-methylbenzylidene)aniline. The last two compounds had not been previously described.

In preliminary studies directed toward obtaining information regarding the mechanism of the polymerization of 2-monosubstitutedaminomethyl-4-t-butylphenols, bis(hydroxybenzyl)amines and quinone methides were proposed as possible intermediates. The isolation of 4-t-butylphenol from the polymerization of 4-t-butyl-2-cyclohexylaminomethylphenol and formation of 4-t-butyl-2,6-dimethylphenol during the pyrolysis of N,N-bis(5-t-butyl-2-hydroxy-3-methylbenzyl)cyclohexylamine indicate the probability of terminal H and CH_3 groups (R in the above formula) in the yellow polymers. The chemical and physical data cited above demonstrated the presence of one anil end group in about half of the polymer chains of these products.

76 pages. $2.00. Mic 57-3045

SOME REACTIONS OF 1,2-DIBROMOCHLOROTRIFLUOROETHANE

(Publication No. 22,220)

Floyd Edward Bentley, Ph.D.
The University of Florida, 1957

In the course of this research problem, the reaction of $CF_2BrCFClBr$ with alcoholic potassium hydroxide has been found to give the olefin, $CF_2=CFCl$ and saturated ethers of the type $ROCF_2CHFCl$. It has been proposed that the ethers arise by the addition of alcohol to the intermediate olefin.

The mechanism of this reaction has been investigated and it appears likely that an initial abstraction of a positive bromonium ion is involved. However, a kinetic study of the reaction of three dibromides, $CF_2BrCFClBr$, CF_2BrCF_2Br, and CF_2BrCCl_2Br, was insufficient to reveal the mechanism of the subsequent beta halide ion elimination. The data are consistent with either a concerted E_2 mechanism or a two stage ElcB mechanism.

Other basic reagents such as sodium diethyl malonate, diethyl amine, and the Grignard reagent also reacted readily with $CF_2BrCFClBr$. In addition, it was found that other vicinal dihalides such as CF_2BrCCl_2Br, CF_2BrCF_2Br, $CF_2ClCFClI$, and $CF_3CClBrCF_2Br$ were also dehalogenated by alcoholic potassium hydroxide.

An attempt to utilize this reaction in syntheses failed when no addition products were obtained between the desired intermediate carbanion of the haloalkane and carbonyl compounds. It is possible that the mechanism of the reaction does not involve a carbanion of finite lifetime.

The decomposition of benzoyl peroxide in $CF_2BrCFClBr$ led to a novel alkylation reaction whereby the acid $CF_2BrCFClC_6H_4COOH$ was prepared in substantial yields. It was suggested that this compound may be a useful intermediate for the preparation of α,β,β-trifluorostyrene by dehalogenation followed by decarboxylation. The reaction also holds some promise as a method of introducing perfluoroalkyl side chains on the aromatic nucleus by the decomposition of benzoyl peroxide in perfluoroalkyl iodides. There was no success in attempts to alkylate the aromatic ring of such co-solvents as benzene and bis-(trifluoromethyl)benzene. Likewise, the decomposition of silver perfluoropropionate in aromatic solvents failed to give alkylated products.

The decomposition of benzoyl peroxide in CH_2BrCCl_2Br gave substantial quantities of bromobenzene and there was some indication that vinylidene chloride, $CCl_2=CH_2$, was formed. However, the product analysis could not entirely explain the failure for this compound to give addition products with olefins in the presence of peroxides.

84 pages. $2.00. Mic 57-3046

SOLVOLYSIS AND ELIMINATION REACTIONS IN THE CYCLODECANE AND CYCLOHEXANE RING SYSTEMS: A KINETIC STUDY

(Publication No. 19,083)

Herbert Hastings Espy, Ph.D.
The University of Wisconsin, 1956

Supervisor: Associate Professor Harlan L. Goering

The ethanolysis of 6-ketocyclodecyl arylsulfonates, which gives [5.3.0]-bicyclodecanone-4, was followed by titration of the acid formed in the reaction. It proceeds through a reversible acid-catalyzed enolization. The enolic ester then may undergo acid-catalyzed reketonization or irreversible solvolysis. The rate constant for enolization is the same for both the ketol p-toluenesulfonate and the ketol p-bromobenzenesulfonate. Once enolized, the latter compound undergoes solvolysis about three times faster than the former. The rate of enolization is markedly reduced by traces of water in the solvent. It may be estimated that the transannular enolic double bond accelerates carbon-arylsulfonate bond cleavage, making it a least 10^3 times faster than in cyclodecyl p-toluenesulfonate.

Similar transannular acceleration by the double bond was found in the solvolysis of trans-5-cyclodecenyl p-toluenesulfonate. The rates of acetolysis and ethanolysis, measured by the method of intermittent titration, are respectively seven and ten times greater than those of cyclodecyl p-toluenesulfonate. The reaction is thought to proceed through ion-pair formation. The ion-pair undergoes solvolysis in competition with rearrangement to a less reactive isomer, which is in turn solvolyzed slowly. The ratio of rearrangement to solvolysis is lower in ethanol than in acetic acid, but the same for different samples of material. This supports the interpretation of rearrangement, rather than impure starting material.

Much previous evidence has shown that the iodide ion-catalyzed debromination of vicinal dibromides proceeds in the trans manner. To determine whether this is required or merely preferred, the rate of this reaction was measured

for cis- and trans-1,2-dibromo- and cis- and trans-1-bromo-2-chlorocyclohexane in 99% methanol at 80 and 100°. The trans dibromide reacts about 11.5 times as fast as the cis isomer, and about 36 times as fast as the trans bromochloride. The cis bromochloride reacts about 40% as fast as the cis dibromide. These observations are consistent with a concerted second-order elimination in the trans compounds, and with S_N2 displacement in the cis compounds to give trans-haloiodides, which then undergo rapid concerted E-2 elimination.

Rate constants have been determined for the dehydrohalogenation of 1,1- and cis- and trans-1,2-dihalocyclohexanes (dibromo-, bromochloro- and dichloro-) and cyclohexyl bromide and chloride in "80%" ethanol containing 0.1 molar sodium hydroxide. Under the conditions of the kinetic experiments the reactions are second-order and E-2 elimination is not accompanied by S_N2 substitution. The solvolytic reactivities of a number of compounds in "80%" ethanol were determined and show that under the dehydrohalogenation conditions, the E-2 reactions are essentially isolate from competing solvolysis except for the 1,1-dihalocyclohexanes. The order of reactivity for the E-2 dehydrohalogenation of the isomeric dihalides is cis-1,2- >>1,1- > trans-1,2-. Under the conditions of the experiments, the 1,1- and cis-1,2-dihalides eliminate one molecule of hydrogen halide; the trans-1,2-dihalides, two molecules. The stoichiometry and relative reactivities indicate that a trans elimination is involved. The relative reactivities, with conformational considerations, provide information about the effects of α- and β-halogen atoms on dehydrohalogenation rates. β-Bromine and β-chlorine increase the rate and decrease the activation energy of dehydrohalogenation by similar amounts. α-Bromine and α-chlorine decrease the rate, the former substituent by more than the latter. 97 pages. $2.00. Mic 57-3047

THE FORMATION OF LINEAR 1,n POLYAMIDES

(Publication No. 22,654)

John J. Farber, Ph.D.
Polytechnic Institute of Brooklyn, 1957

Adviser: Herman F. Mark

Various syntheses of 1,n- polyamides

$$-[NH\text{-}CH_2\text{-}NH\text{-}CO\text{-}(CH_2)_{n-2}\text{-}CO]-$$

and their reaction products were studied. It was shown that the direct method of synthesis used by previous workers resulted in partially crosslinked products. These compounds, polyamides type I, have very low solubility and melt only with decomposition. Linear 1,n polyamides were synthesized by a two step synthesis to yield a polyamide type II. The physical properties of both types of polymers were compared.

The assumptions about differences in structure were confirmed by formation of N-substituted derivatives. The influence of the type and extent of substitution on the properties of both types of polyamides were also studied. The polyamide type I could be obtained from polyamide type II by partial crosslinking.

It was shown that the necessary presence of large amounts of strong acid in the reaction mixture results in an equilibrium between the formation and the degradation of the polymer chains. 52 pages. $2.00. Mic 57-3048

THE CLEAVAGE OF DISULFIDE POLYMERS BY INORGANIC SULFIDES, THIOLS, AND DISULFIDES

(Publication No. 22,655)

Edward M. Fettes, Ph.D.
Polytechnic Institute of Brooklyn, 1957

Adviser: H. Mark

The cleavage of disulfide groups by various reagents had previously been studied in an irregular way. Little attention has been given to the effect of structure of the disulfide on its cleavage by inorganic sulfides, thiols, and disulfides. Most of the published work has been concerned with the disulfide linkage present in cystine products. There has been a great tendency to assume that the reactivity of cystine is characteristic of all disulfides whereas the disulfide linkage in cystine is exceedingly reactive and very different from ordinary aliphatic and aromatic disulfides. Interest in the exchange reaction of a thiol with a disulfide has recently been stimulated by its significance in the denaturation of proteins. Both homolytic and heterolytic scissions of the disulfide group have been postulated for the thiol/disulfide interaction.

The polysulfide polymers which contain aliphatic disulfide linkages in the backbone were selected for the study of cleavage by varying reagents. This provides a very sensitive tool for determining relatively small amounts of cleavage. The molecular weight of the polymer is so profoundly effected by any scission of the chain that the relative effect of various reagents can easily be determined by measurement of any property dependent on the molecular weight of the polymer as well as the molecular weight itself.

Aliphatic disulfide groups are readily cleaved by aqueous solutions of inorganic sulfides. The reaction is reversible with the equilibrium favoring formation of the disulfide linkage. In an aqueous system a portion of the disulfide polymers is solubilized as the salts of dithiols of low molecular weight. The extent of hydrophilic nature of the low molecular weight fragments greatly affects the amount of solubilized material. These facts are shown to be exceedingly important toward the mechanism of formation of polysulfide polmyers of a high molecular weight. The equilibrium is displaced to cleave the disulfide linkages to thiols if a reagent capable of binding sulfur is present.

The cleavage of aliphatic disulfide polymers by thiols was studied both in hetergeneous dispersions in water and homogeneous solutions. The reaction proceeds by an ionic mechanism with the mercaptide ion being the true reactant. Basic catalysts accelerate very markedly the rate of reaction.

The reaction of an organic disulfide with the disulfide polymer does take place but it seems improbable that a true exchange reaction is occurring. It appears that cleavage of the organic disulfide first occurs to form a

mercaptide which then reacts with the disulfide group of the polymer. Sodium polysulfide is needed to convert aliphatic disulfides to mercaptides but water is apparently sufficient to cause aromatic disulfides to react. Thiuram and benzothiazyl disulfides are particularly active in cleaving disulfide polymers probably because of the basic group present in the molecule. 107 pages. $2.00. Mic 57-3049

THE OXIDATION OF HYDROGENATED LIGNIN FROM DOUGLAS FIR WOOD

(Publication No. 22,168)

Donald Paul Granquist, Ph.D.
University of Washington, 1957

Lignin was obtained from Douglas Fir wood by treatment with a dilute alkaline solution under hydrogen pressure and in the presence of an appropriate catalyst at elevated temperatures. The lignin preparation was rehydrogenated in dioxane solution to further increase the degree of saturation. The rehydrogenated lignin, after distillation of the dioxane, was subjected to an oxidative procedure with nitric acid as the oxidant. Following esterification of the organic acids formed by oxidation, the esters were separated into small product fractions by vacuum distillation. Finally, one of the products of distillation was identified as the diethyl ester of dimethylmalonic acid. Other product fractions, separated but not completely identified, were presumed to be higher molecular weight homologues of the identified product.

It is suggested that substances structurally related to thujic acid may exist in Douglas Fir wood and could give rise to the observed dimethyl malonic acid.

97 pages. $2.00. Mic 57-3050

CONDENSATION OF HYDROQUINONE AND FORMALDEHYDE WITH PRIMARY AMINES

(Publication No. 22,148)

Charles Rankin Hammer, Ph.D.
University of Utah, 1957

Chairman: W. J. Burke

Recent investigation has shown that condensation of hydroquinone and formaldehyde with benzylamine in a molar ratio of 1:4:2 formed two products, both of which gave analyses in agreement with that calculated for a bis-m-oxazine. In the present study, these two products were shown to be 2,9-dibenzyl-1,2,3,8,9,10-hexahydrobenzo[2,1-e,3,4-e']bis-m-oxazine and 3,8-dibenzyl-2,3,4,7,8,9-hexahydrobenzo [1,2-e,4,5-e']bis-m-oxazine.

The oxazine rings of these compounds were cleaved by hydrochloric acid to form Mannich base hydrochlorides, which in turn were transformed to the corresponding bis-(morpholinomethyl)-hydroquinones by amine interchange. One of these proved to be identical with 2,5-bis-(morpholinomethyl)-hydroquinone. The other product was demonstrated to be the previously unknown 2,3-bis-(morpholinomethyl)-hydroquinone by hydrogenolysis followed by oxidation to form 2,3-dimethylbenzoquinone.

Condensations of hydroquinone and formaldehyde with various other primary amines were studied. When α-methylbenzylamine was used, two products were isolated. These were shown to be analogous to the benzyl compounds by reactions similar to those used to establish the structures of the benzyl compounds.

Only one product was isolated from each analgous condensation involving as the primary amine cyclohexylamine, t-butylamine, allylamine, or 2-aminoethanol. That these products were the corresponding 3,8-dialkyl-2,3,4,7,8,9-hexahydrobenzo[1,2-e,4,5-e']bis-m-oxazines was demonstrated for each amine with the exception of 2-aminoethanol. Attempts to condense aromatic amines with hydroquinone and formaldehyde to form similar products were unsuccessful.

Amine interchange of 2,5-bis-(dimethylaminomethyl)-hydroquinone with benzylamine and cyclohexylamine gave analogous Mannich bases. These were also obtained from the corresponding oxazines, as were 2,3-bis-(benzylaminomethyl)-hydroquinone and 2,5-bis-(t-butylaminomethyl)-hydroquinone.

Earlier related work on the condensation of monohydric phenols with formaldehyde and primary amines demonstrated the importance of the basic strength of the amine and the number of hydrogen atoms on the carbon attached to the amino group in determining the course of the reaction. No evidence was found in the present study to indicate that these factors were important in controlling the type of product formed. The only common structural feature in the primary amine which could be correlated with the isolation of the two possible isomeric bis-m-oxazines was the presence of a benzyl group attached directly to nitrogen. 53 pages. $2.00. Mic 57-3051

THEORETICAL STUDIES OF THE PROPERTIES OF POLYAMMONIUM COMPOUNDS

(Publication No. 22,237)

William J. Husa, Jr., Ph.D.
The University of Florida, 1953

The anion exchange characteristics of thirteen polymers of quaternary ammonium compounds were investigated. The capacities, stabilities, and rates of attaining equilibrium were compared.

Polymer samples in the bromide form were converted to the hydroxide form and were allowed to come to equilibrium in solutions which had contained a definite amount of HBr and which were also 1 N in KBr. A titration curve was constructed for each and the limiting exchange capacities were calculated from the quantity of acid consumed by samples from solutions which still contained excess acid at equilibrium.

The instabilities observed for certain polymers were correlated with the structures and steric hindrance present when the polymers were formed was advanced as the explanation. 124 pages. $2.00. Mic 57-3052

ON THE ISOLATION AND PURIFICATION OF THE ALLERGENICALLY ACTIVE ALKENYL PHENOLS OF POISON IVY AND RELATED PLANTS

(Publication No. 21,803)

Kenneth Helmut Markiewitz, Ph.D.
Columbia University, 1957

The chemical nature of the toxic principle of poison ivy has long been of interest to chemists. Recently the structures of the toxic components of poison ivy have been established in these laboratories. It is now known with certainty that the toxic material (poison ivy "urushiol") is made up of four components having the carbon skeleton of 3-pentadecylcatechol, and differing from each other only in the degree of unsaturation in the 15 carbon side chain. In other words, poison ivy "urushiol" is a mixture of a saturated, mono-, di, and a tri-olefinic constituent. These recent investigations were conducted on the dimethyl ethers of the individual components. Such methyl ethers are not allergenically active, and it has not been possible to hydrolyze them, in order to regenerate the free catechols, without causing destruction to the rest of the molecule.

Most clinical investigations on poison ivy dermatitis up to now have been handicapped by the fact that chemically pure poison ivy "urushiol" has not been available for study. The only component of "urushiol" that has been available in pure form for clinical investigations in recent years is the saturated component (3-pentadecylcatechol), made available by synthesis. Prior to these investigations only crude "urushiol extracts of unknown concentration, stability and composition were available. An attempt to obtain these components by synthesis has so far only yielded the saturated and mono-olefinic component. Therefore it has been the object of this investigation to develop a method for obtaining from the poison ivy plant each of the toxic components in the chemically pure and dermatologically active (free phenolic) form.

An extract obtained from the poison ivy plant was benzylated and the dibenzyl ethers were purified chromatographically. Using the techniques of absorption chromatography the "urushiol" was separated into its four components. An estimate was made of the percentage of each component present.

A method was developed for the cleavage of benzyl ethers in molecules containing also multiple unsaturation centers separated only by one methylene group. Unsaturated systems of this type are highly reactive. They rearrange readily in the presence of alkali, polymerize in the presence of acid, or when strongly heated, and autoxidize with great ease on exposure to air. All previously known reagents for the cleavage of benzyl ethers act under conditions at which one or more of the above reactions take place. It was found that when benzyl ethers are allowed to react with a potassium-sodium alloy sand at relatively low temperatures, and the reaction products slowly decomposed with acetic acid, cleavage proceeds quickly, quantitatively and without the formation of decomposition or side products. Thus it was possible to regenerate the free phenols in the allergenically active form.

The last traces of impurities were removed by a molecular distillation. The products had the expected UV and IR spectra. Their refractive indices were self-consistent and agreed with those calculated on the basis of independent data. Using a microhydrogenation technique, the unsaturation values of all products were found to be as expected and the hydrogenated products were identified as 3-pentadecylcatechol. One component (the monoolefin) was compared directly with an authentic sample made previously by synthesis and was found to be identical. Two of the components, the di- and tri-olefins, have been obtained for the first time in the phenolic form. It appears that the procedures developed in the investigation should have wide application to the problem of separating the various olefinic alkenyl phenols of other members of the family Anacardiaceae. 138 pages. $2.00. Mic 57-3053

SYNTHESIS OF CERTAIN DERIVATIVES OF 1-AZULENETHIOL AND 1,3-AZULENEDITHIOL

(Publication No. 22,177)

Richard Norman McDonald, Ph.D.
University of Washington, 1957

The azulene utilized in this investigation was synthesized by a three-step modification, developed by B. M. Steckler and D. J. Gale, of a five-step sequence reported by K. Ziegler. This involved treatment of a diethylene glycol solution of cyclopentadiene and sodium methoxide with 1,5-bis-(N-methylanilino)pentamethinium chloride forming (5-(N-methylanilino)pentadienylidene)cyclopentadiene, followed by dilution with diethylene glycol, heating to 205° and steam distillation of the product with superheated steam. The author contributed to studies preliminary to this synthesis and assisted in the scale-up of the procedure.

Azulene and certain 1-substituted azulenes were treated with sulfur trioxide-dioxane adduct in attempts to prepare the various sulfonic acids. The only identifiable products obtained were sodium 1-azulenesulfonate, by treatment of the sulfonic acid with sodium carbonate, and azulene-1-sulfonyl-3-sulfinyl dichloride, by treatment of 1-azulenesulfonic acid with thionyl chloride. Attempts to prepare the methyl ester or S(p-bromobenzyl)thiuronium salt of 1-azulenesulfonic acid failed to give the desired products.

Azulene was found to undergo ready substitution with 2,4-dinitrobenzenesulfenyl chloride to give 2,4-dinitrophenyl azulyl sulfide. Cleavage of the sulfide with base gave diazulene-1,1'-disulfide rather than the expected 1-azulenethiol.

Thiocyanation of azulene was very effective, yielding either 1-thiocyanoazulene or a mixture of 1-thiocyanoazulene and 1,3-dithiocyanoazulene, depending on the conditions employed.

1-Thiocyanoazulene was found to brominate with N-bromosuccinimide and to couple with benzenediazonium chloride to give the corresponding 3-bromo and 3-phenylazo compounds. Nitration yielded the 3-nitro derivative which on reduction, under acetylative conditions at room temperature, yielded N,S-diacetyl-3-amino-1-azulenethiol, rather than the expected N-acetyl-1-thiocyano-3-aminoazulene.

Reduction of 1-thiocyanoazulene was effected at the reflux temperature of the acetylative reducing mixture to give S-acetyl-1-azulenethiol. This was found to be easily converted to diazulene-1,1'-disulfide by chromatography over basic alumina, or by acid or base hydrolysis conditions.

Bromination and nitration of S-acetyl-1-azulenethiol yielded the corresponding 3-bromo and 3-nitro derivatives. The 3-bromo compound was also prepared by acetylative reduction of 3-bromo-1-thiocyanoazulene.

In an attempt to prepare the S-acetyl-3-phenylazo-1-azulenethiol, benzenediazonium chloride was allowed to react with S-acetyl-1-azulenethiol. The product was not the one expected, but rather, 3,3'-di(phenylazo)diazulene-1,1'-disulfide.

Aqueous chlorine oxidation of S-acetyl-3-bromo-1-azulenethiol and 1-thiocyano-3-bromoazulene gave only tars as products, and not the expected 3-bromo-1-azulene-sulfonyl chloride. 133 pages. $2.00. Mic 57-3054

THE REACTION OF BIGUANIDE WITH ESTERS. THE PREPARATION OF PYRIMIDINE AND TRIAZINE POLYMERS AND COPOLYMERS.

(Publication No. 22,658)

Francis W. Michelotti, Ph.D.
Polytechnic Institute of Brooklyn, 1957

Adviser: Charles G. Overberger

It was the purpose of this investigation to examine the detailed kinetics of the photoreduction of triphenylmethane and fluorescein-type dyes when bound to high-polymeric substrates. The rate of photoreduction by ascorbic acid of bound dye molecules was investigated as a function of the degree of binding, dye concentration, reductant concentration and light intensity.

Triphenylmethane dyes do not undergo photoreduction at all unless they are bound to water-soluble high polymeric substrates. The rates of photoreduction of fluorescein-type dyes are considerably increased upon binding of these dyes to polyvinylpyrrolidone. In contrast, the reduction of these dyes in the dark by strong reducing agents is actually inhibited when the dyes are bound.

In several respects the photochemical behavior of the bound dyes is different from that of free fluorescein type dyes. Whereas, with the latter, when free, the quantum yield of photoreduction decreases with increasing dye concentration, for bound dyes the quantum yield increases with increasing dye concentration. Nitrobenzene retards the rate of fading of free dyes, while in the case of bound dyes the reaction is inhibited until all the nitrobenzene is consumed, after which the reaction proceeds at a rate equal to that for the inhibitor-free system.

p-Phenylenediamine and potassium iodide retard the photoreduction of free fluorescein-type dyes. They are without effect on the rate of photoreduction of bound triphenylmethane dyes, but do have a marked effect on the photoreduction of bound fluorescein-type dyes. p-Phenylenediamine causes a period of inhibition, after which the reaction proceeds at a reduced rate compared to that of the inhibitor-free system. Both the duration of the inhibition period and the amount of retardation are proportional to the amount of p-phenylenediamine added. Potassium iodide, at concentration less than 3×10^{-3} mol./1. increases the rate of photoreduction of bound fluorescein-type dyes; at higher concentrations it exerts a retarding effect.

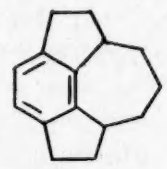
Analysis of the kinetic data shows that bound long-lived excited dye molecules react with the reductant to give colorless products. Interaction between bound dye molecules in the ground state and those in the first electronically excited singlet state is the principal mechanism for the formation of long-lived dye molecules. Confirmation of this reaction step is the fact that self-quenching of the fluorescence of bound dye molecules occurs at abnormally low dye concentrations. 91 pages. $2.00. Mic 57-3055

AN EXAMINATION OF THE SYNTHETIC ROUTES LEADING TO DICYCLOPENTA[de,kl]HEPTALENE

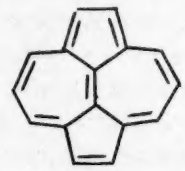
(Publication No. 22,178)

Andrew Frederick Montana, Ph.D.
University of Washington, 1957

This thesis deals with the synthesis of 1,2,5,6,7,8,9,9a-octahydro-6aH-dicyclopenta[de,jk]cycloheptabenzene (I) a possible precursor to dicyclopenta[de,kl]-haptalene (II).



I



II

Two principle routes leading to the synthesis of the tetracyclic hydrocarbon (I) have been examined. The first route consisted of improved synthesis for the conversion of 1-indanone to 2,6,7,8,9,9a-hexahydro-1H-cyclohept[cd]-indene-6-one via both Reformatsky and Grignard reactions followed by the subsequent conversion of the known tricyclic ketone to the new tetracyclic system.

The second approach involved the conversion of 6,7,8,-9-tetrahydro-5H-cycloheptabenzene to 1,2,5,6,7,8,9,9a-octahydro-6aH-dicyclopenta[de,jk]cycloheptabenzene-2-one, a tetracyclic intermediate in the synthesis of I. Although the synthesis via this second route involved two less steps, the first route was found to be of more value since the over-all yield from starting materials to the final products was found to be considerably higher.

It was found that the two synthetic routes resulted in stereoisomeric tri- and tetracyclic derivatives and evidence for the configuration of the isomers is given.

103 pages. $2.00. Mic 57-3056

A STUDY OF SOME HYDROXYLATION REACTIONS

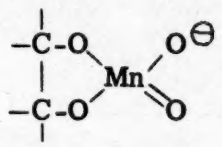
(Publication No. 22,185)

Klaus Arthur Saegebarth, Ph.D.
University of Washington, 1957

This thesis describes an investigation directed toward the elucidation of the mechanisms of some hydroxylation reactions employing stereochemical considerations and also oxygen-18 as a tracer. The methods that were

examined have been the hydroxylation of olefins with dilute potassium permanganate, the Prevost reaction and the direct addition of hydrogen peroxide to the double bond under the influence of tungsten trioxide.

The oxidation of an aqueous solution of oleic acid was effected at about pH 12 with a dilute solution of potassium permanganate-0^{18} in an almost quantitative yield. Total enriched oxygen analysis of the resulting diol indicated that the oxygen introduced into oleic acid in its conversion to 9,10-dihydroxystearic acid by permanganate arose from the oxidizing agent. This observation and also the fact that the permanganate reaction invariably results in a cis-addition of the two hydroxyl groups gives strong evidence for the formation of a cyclic ester intermediate (I) in the hydroxylation of olefins with potassium permanganate. It

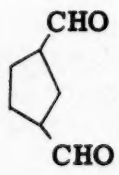


I

has previously been shown that the high yield of diol from oleic acid is obtained only in a basic solution, and a mixture of 9,10- and 10,9-ketohydroxystearic acids is obtained in neutral solution. These results only apply to oxidations carried out in aqueous solution. In an effort to see if a ketol might be obtained in a neutral potassium permanganate oxidation when a mixture of an organic solvent and water was employed as the reaction medium the reaction of bicyclo[2.2.1]-2-heptene (II) was studied and was found to give cyclopentane-1,3-dicarboxaldehyde (III) as the



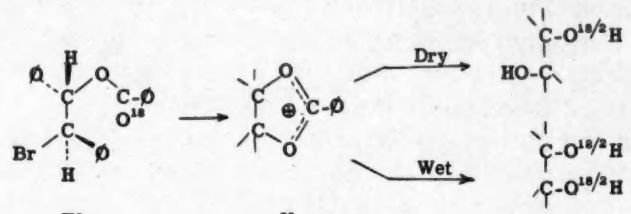
II



III

major product. On the other hand, the oxidation of cyclopentene, cyclohexene, cycloheptene and bicyclo[2.2.1]-2-heptene at about pH 13 in a t-butyl alcohol-water medium gave fair yields of the corresponding cis-1,2-diol and no aldehydic material could be detected. A mechanism for the formation of the diol, ketol and dialdehyde from a common intermediate are discussed.

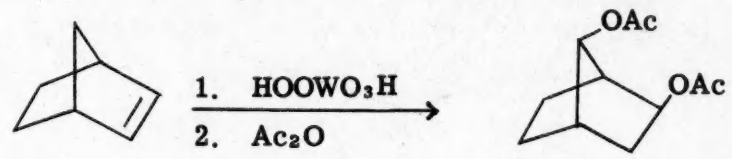
The oxidation of olefins with bromine or iodine, in a dry inert solvent, in the presence of silver benzoate, the Prevost reaction, results in the formation of trans-1,2-glycol dibenzoates. The stereochemical course of this reaction is clearly dependent upon the nature of the solvent medium, since when the reaction is carried out in acetic acid containing a stoichiometric amount of water a cis-addition is predominant. These observations can now be rationalized by the formation of a cyclic benzoxonium ion intermediate (V) since the treatment of erythro-1-benzoxy-2-bromo-1,2-diphenylethane-carbonyl-0^{18} (IV) with silver benzoate under the dry and "wet" conditions resulted in a transfer of the carbonyl oxygen which is compatible with the formation of the cyclic intermediate (V). The "wet" Prevost technique, i.e., the reaction of an olefin with iodine and silver acetate in moist acetic acid, has also been demonstrated to be quite general as a cis-hydroxylation procedure. The mechanisms of both methods, "wet" and



IV V

dry, are discussed in light of their direct analogy to the classical neighboring acetoxy group displacement reactions.

The ionic nature of the pertungstic acid catalyzed trans-addition of hydrogen peroxide to an olefin has been clearly demonstrated since the reaction with bicyclo[2.2.1]-2-heptene gave as the predominant reaction product (VI), one which was a consequence of a Wagner-Meerwein rearrangement, a familiar feature of the bicycloheptyl cations. When



II VI

crotyl alcohol was allowed to react with tungsten trioxide dissolved in a solution of hydrogen peroxide in water-0^{18} the total enriched oxygen content of the resulting butane-1, 2,3-triol-0^{18} indicated that one of the hydroxyl groups was derived from the oxidizing agent and the other from the solvent. These results are interpreted and the two possible mechanisms: (a) via an epoxide intermediate, or (b) by a concerted 1,2-trans-addition, are discussed.

161 pages. $2.15. Mic 57-3057

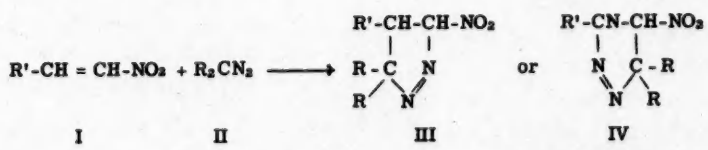
REACTIONS OF NITROOLEFINS WITH DIAZOCOMPOUNDS

(Publication No. 22,496)

Carl Serres, Jr., Ph.D.
University of Minnesota, 1956

Adviser: W. E. Parham

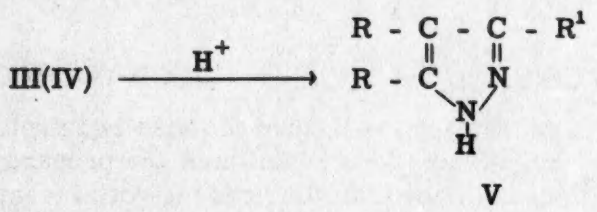
The purpose of this study was to determine the structure of the nitropyrazolines (III or IV) which are formed by the reaction of nitroolefins of type I with disubstituted diazomethanes (II).



I II III IV

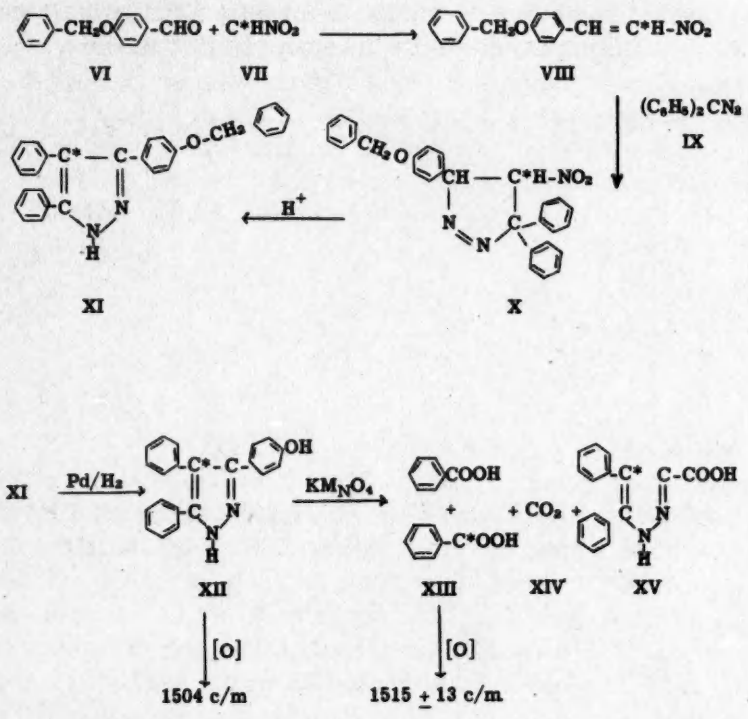
It has been shown by Parham and Hasek[1] that such nitropyrazolines undergo an acid-catalyzed elimination and rearrangement reaction which results in the formation of pyrazoles of type V. The mechanism of this reaction may be postulated once the structure of the nitropyrazolines is known.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.



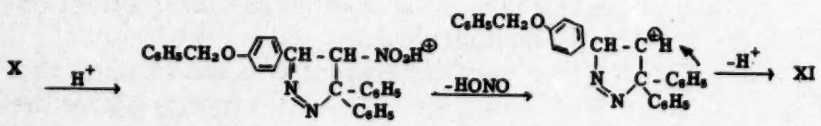
V

The problem was attacked and solved by use of a carbon-14 isotopic tracer study. The results are summarized in the following series of equations. The asterisks indicate the labeled positions.

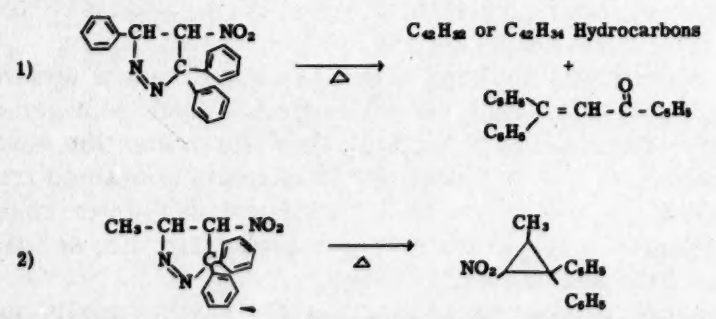


The results clearly show that the reaction of VIII and IX yields a 4-nitropyrazoline (X) rather than a 3-nitropyrazoline as had previously been supposed.

The mechanism of the acid-catalyzed decomposition of X was then postulated to occur as follows.



The thermal decomposition of two selected 4-nitropyrazolines was also studied. This work is summarized in the following equations.



82 pages. $2.00. Mic 57-3058

1. W. E. Parham and W. R. Hasek. J. Am. Chem. Soc., 76, 799 (1954).

THE PREPARATION AND PROPERTIES OF ALKOXY SUBSTITUTED COMPLEX HYDRIDES

(Publication No. 22,297)

Charles Jefferson Shoaf, Ph.D.
Purdue University, 1957

Major Professor: Herbert C. Brown

In refluxing tetrahydrofuran the rate of reaction of sodium hydride with borate esters decreases sharply in the order: methyl > ethyl >> isopropyl >> t-butyl. The time required to achieve reaction in the case of isopropyl and t-butyl borates can be greatly reduced by operating in the dimethyl ethers of di- and triethylene glycol at 130-150°. Sodium trimethoxyborohydride and triethoxyborohydride undergo disproportionation in tetrahydrofuran solution, whereas the isopropoxy and t-butoxy derivatives appear to be stable to this reaction. In contrast to sodium borohydride, sodium triisopropoxyborohydride reduces ethyl benzoate at a moderate rate. The stability of the triisopropoxy- and tri-t-butoxyborohydrides toward disproportionation is attributed to the strain in the corresponding tetraalkoxyborohydrides, a necessary product of the disproportionation. The higher reactivity of the trialkoxyborohydrides as compared to the parent compound is attributed to the greater ease of removing hydride ion from a weak Lewis acid, alkyl borate, as compared to the removal from a strong Lewis acid, borine.

Lithium trimethoxyaluminohydride and tri-t-butoxyaluminohydride can be prepared by the addition of the corresponding alcohol to a lithium aluminum hydride solution in a 3:1 molar ratio. Lithium trimethoxyaluminohydride may also be prepared by the reaction of lithium aluminum tetramethoxide with a lithium aluminum hydride solution in the dimethyl ether of diethylene glycol. Lithium trialkoxyaluminohydrides are soluble in tetrahydrofuran and the dimethyl ether of diethylene glycol. They are insoluble in diethyl ether. Lithium triethoxy- and triisopropoxyaluminohydride were obtained as mixtures with the di- and tetraalkoxy derivatives. Lithium trialkoxyaluminohydrides, unlike the analogous sodium trialkoxyborohydrides, are free from disproportionation. Also, they are weaker reducing agents than their parent compound, lithium aluminum hydride. This is attributed mainly to a steric effect with the possibility of some polar effect contributing also.

Good yields of aldehydes can be obtained from the reduction of aliphatic nitriles with lithium triethoxyaluminohydride in diethyl ether. This is apparently due to the formation of an insoluble reaction intermediate and is a result of this solvent effect. The method appears to be general for almost all nitriles.

197 pages. $2.60. Mic 57-3059

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

THE SYNTHESIS AND PROPERTIES OF AN ALLENIC NITRILE

(Publication No. 22,498)

Jack Spencer Swenson, Ph.D.
University of Minnesota, 1956

Adviser: Lee Irvin Smith

The synthesis of the first known conjugated allenic nitrile, 2-cyanopentadiene-2,3 (IV), was accomplished via the following sequence of reactions:

1) $CH_3C{\equiv}CH + EtMgBr \xrightarrow{\text{dry ether}} CH_3C{\equiv}CMgBr + EtH$

2) $CH_3C{\equiv}CMgBr + CH_3CHO \xrightarrow[\text{hydrolyze}]{\text{then}} CH_3C{\equiv}C\underset{\displaystyle OH}{\underset{|}{C}}HCH_3$ (I)

3) $CH_3C{\equiv}C\underset{\displaystyle OH}{\underset{|}{C}}HCH_3 + PBr_3 \xrightarrow[\text{ether}]{\text{dry}} CH_3C{\equiv}C\underset{\displaystyle Br}{\underset{|}{C}}HCH_3$ (II)

4) $II + CuCN \xrightarrow[\text{benzene}]{\text{dry}} CH_3C{\equiv}C\underset{\displaystyle CN}{\underset{|}{C}}HCH_3 + CH_3\underset{\displaystyle CN}{\underset{|}{C}}{=}C{=}CHCH_3$
(III) (IV)

5) $III + IV + NaOMe \xrightarrow{\text{dry ether}} CH_3CH{=}C{=}\underset{\displaystyle CH_3}{\underset{|}{C}}{-}C{\equiv}N$ (IV)

Reactions 1, 2 and 3 were examples of well known reactions. Reaction 4 led to a mixture of III and IV. The allenic nitrile (IV) resulted from a carbonium ion type propargylic rearrangement which took place during reaction 4. It was impossible to separate III or IV from the mixture of the two by physical methods.

However, when the mixture of III and IV was subjected to action of sodium methoxide suspended in dry ether it was possible to rearrange the III in the mixture completely to IV (reaction 5). That is, III was rearranged to IV by means of a base catalyzed 1,3-prototropic shift which is an example of the carbanion type propargylic rearrangement. Therefore, it was possible to arrive at the same allenic nitrile (IV) by means of two different types of propargylic rearrangements.

The structure of IV was established by catalytic hydrogenation of the allenic linkage and hydrolysis of the nitrile to the corresponding saturated amide, 2-methylpentanamide (V): $CH_3CH_2CH_2\underset{\displaystyle CH_3}{\underset{|}{C}}H\text{-}\overset{\displaystyle O}{\overset{\|}{C}}\text{-}NH_2$. The allenic linkage in IV showed surprising resistance to catalytic hydrogenation.

Several addition reactions to the conjugated allenic system in IV were studied. Attempts were made to add p-diphenylmagnesium bromide, ethylmagnesium bromide, phenyllithium and ethyl sodiomalonate to IV. However, the products in each case were polymeric in nature. Thus polymerization was initiated by reagents which could initially add to the allenic nitrile; polymerization of the nitrile could also be induced by heat.

Two other research problems, one the synthesis of a beta, gamma-acetylenic ketone, 1-phenyl-2-methylpent-3-yne-1-one (VII), and the other the synthesis of a conjugated allenic ketone, 1,4-diphenylbuta-2,3-diene-1-one (XII), failed.

$CH_3C{\equiv}CCH(CH_3)\overset{\displaystyle O}{\overset{\|}{C}}C_6H_5$ (VII)

$C_6H_5CH{=}C{=}CH\overset{\displaystyle O}{\overset{\|}{C}}C_6H_5$ (XII)

The chief reason for the failure of these two problems was that the Reformatsky type reaction of the propargyl bromide with benzaldehyde in the presence of zinc gave an inseparable mixture of products instead of the expected beta, gamma-acetylenic alcohol. The acetylenic alcohols were key intermediates in both syntheses.

A fourth research project was the synthesis of 1,2,3-trinitro-1,2-diethylcyclopropane (XVI). This project was abandoned when it proved impossible to add any reagent to the double bond of 3,4-dinitro-3-hexene (XIII) which was one of the intermediates in the proposed synthesis.

$CH_3CH_2C(NO_2)C(NO_2)CH_2CH_3$ (XVI)
$\quad\quad\quad

CHEMISTRY, PHYSICAL

A SPECTROSCOPIC STUDY OF SELECTED DIPHENYL AND TRIPHENYLMETHANE DYES

(Publication No. 22,154)

Frank Cuthbert Adam, Ph.D.
University of Washington, 1957

The degenerate transition of Crystal Violet (I) near 580mμ was found to be split by either chemical substitution in only one ring, or by asymmetrical ion pairing in non-polar solvents. The sign of the perturbation was determined by considering the polarization of the weak transition near 360mμ. For the dyes of the Malachite Green series, the moment of the low energy transition is directed between the nitrogen atoms (x). For I in non-polar solvents, and 4,4'-Bisdimethylamino Fuchsone(II), the moment is directed perpendicularly to this direction (y). For II, the perturbation is due to the effect of charge separation and not to the intrinsic basicity of oxide ion, which is a perturbation in the other direction.

Also studied were the diphenylmethane dyes Auramine (III), Acetyl Auramine (IV) and Michler's Ketone (V). The first three transitions were assigned. Intensity calculations based on a method using classical valence structures were carried out for dyes II to V, considering only the two low energy transitions. The moments so calculated were found to agree very closely to the observed values, especially for the x-polarized transitions. The deviations are discussed in terms of the existing perturbations experienced by the molecules.

132 pages. $2.00. Mic 57-3062

STUDIES IN MOLECULAR SPECTROSCOPY: INFRARED BAND SHAPES AND VIBRATIONAL PARAMETERS IN NF_3

(Publication No. 21,269)

Seymour Bakerman, Ph.D.
Purdue University, 1957

Major Professor: Walter F. Edgell

An intensive study has been made of the degenerate bands of NF_3 to verify the theory of Edgell and Gallup that a Beer-Lambert type law should hold for spectrometer tracings of infrared bands in an intermediate pressure range providing a number of conditions are fulfilled. It was found that the above law held for T and T_o at every frequency in the P and R branches of ν_4 and across the whole ν_3 band when sufficient N_2 had been added to pressure broaden the lines. The slopes of the ln T_o/T vs. pl lines gave $\bar{\alpha}$ at each frequency. The area of the $\bar{\alpha}$ vs. ν plot gave the total integrated absorption coefficient and the values were checked for the ν_3 band by the standard Wilson-Wells technique with excellent agreement.

Coriolis coupling constants for the perpendicular bands were obtained by a comparison of the experimental bands with the atlas of band shapes computed by Edgell and Moynihan and combining this parameter with the fundamental frequencies, mathematical methods have been developed for obtaining unambiguous intra-molecular forces and atomic displacements for these vibrations. The atomic displacements and area data were combined to give values for the N-F bond dipole moment μ_o and $\partial\mu/\partial r$ without the usual uncertainty resulting from the ambiguity in displacements. 135 pages. $2.00. Mic 57-3063

THE INTERACTION OF POLYVINYLPYRROLIDONE WITH CO-SOLUTES

(Publication No. 22,650)

Stanley M. Barkin, Ph.D.
Polytechnic Institute of Brooklyn, 1957

Adviser: Frederick R. Eirich

The study of the interaction of poly-N-vinylpyrrolidone (PVP) with co-solutes in aqueous solution has been extended, from iodine and dyestuffs, to include detergents. The interactions were studied by dialysis equilibrium, light scattering, viscosity, spectrophotometric, and conductance methods. Typical detergent materials such as dodecyl sodium sulfate (DSS), Nacconol NRSF, and sodium oleate, were found to be bound by PVP. As the alkyl chain length of the sulfated alcohols decreases, the extent of interaction was found to decrease until no interaction was detectable for materials of methylene chain length 7 or smaller. Lauroyl methyl tauride interacted only to a slight extent with PVP, while experiments with a typical cationic and a non-ionic detergent failed to show any strong interaction.

The binding of DSS by PVP was studied in detail. At low DSS concentrations the extent of binding is small. An abrupt increase in adsorption is noted as the DSS concentration is increased, which continues until a maximum in the binding is reached somewhat beyond the critical micelle concentration (CMC) of the free detergent. Conductance, light scattering, and spectrophotometric measurements show that the properties of PVP-DSS solutions undergo relatively abrupt changes as the extent of binding increases. The results are interpreted as showing that, at low binding densities, the detergent is aligned along the hydrocarbon backbone of the polymer. The increase in binding and subsequent changes in the solution properties of the system are thought to be due to detergent-detergent interactions that proceed between bound and bound detergent, and between bound and free detergent in solution, leading to aggregation of the detergent in some condensed, probably micellar form on the polymer. When the CMC of the free DSS is reached, a substantial concentration of free micelles appears and effectively competes with the PVP for the bound detergent, thereby causing the binding to go through a maximum.

The binding of DSS to PVP converts the polymer to a polyelectrolyte. The viscosity of the PVP-DSS complex exhibits an electroviscous effect and, at high detergent concentrations, the reduced viscosity as a function of the polymer concentration goes through a maximum.

In salt solutions, a reduction of the reduced viscosity of the PVP-DSS complex is observed and is attributed to the suppression of the electroviscous effect by the extraneous electrolyte and to an intramolecular "cross-linking"

mechanism; the "cross-links" presumably arise from an aggregation of bound detergent molecules. Similar effects have been noted for iodine and dyestuff (Orange II) interaction with PVP.

The reduced viscosity of the PVP-DSS complex decreases drastically with decreasing pH. The possibility is considered, that the polymer at low pH, acquires positive binding sites for the detergent anion. Eventually, at a pH less than 1, the complex precipitates. The lower alkyl homologues of DSS also precipitate with PVP at low pH, but require a higher detergent concentration the shorter the alkyl group. The C_2 homologue, even at concentrations greater than 1 molar, does not precipitate with PVP at any pH. 118 pages. $2.00. Mic 57-3064

INFRARED INTENSITIES AND BOND MOMENTS IN CH_3F AND CD_3F

(Publication No. 22,156)

Gordon Dean Barnett, Ph.D.
University of Washington, 1957

Infrared studies of the intensities of the fundamental bands of CH_3F and the fully deuterated isotope of this molecule were undertaken to determine the bond polar properties of the compound. As a requisite of this problem it was first necessary to determine the magnitudes of the forces which are assumed to exist in the molecule since these forces play an important role in determining the motion of the atom during vibration. To determine a unique set of force constants for methyl fluoride, zeta-values and centrifugal distortion values were used. An International Business Machine #650 was used as an aid in computing the values of the molecular force constants. The force constants were related not to observed, but to zero-order frequencies. It is felt that the values for these quantities presented here are much more accurate than values previously calculated.

Bond polar properties for methyl fluoride were calculated from these new force constant values and intensity measurements for CH_3F and CD_3F. Dipole moment changes and bond dipole moments associated with parallel vibrations were determined in magnitude and in direction relative to one another; these quantities for perpendicular vibrations were determined in direction as well as magnitude as a result of a consideration of the required rotation of the molecule occurring during these vibrations.

The values calculated for the bond polar properties of methyl fluoride seem to follow trends established for other methyl halides. These trends require more experimental justification to be totally valid.

87 pages. $2.00. Mic 57-3065

ELECTROPHORETIC AND EQUILIBRIUM DIALYSIS STUDIES OF THE INTERACTION OF CERTAIN ORGANIC ANIONS WITH BOVINE WHEY PROTEIN

(Publication No. 21,749)

Ellsworth Benjamin Beetch, Ph.D.
Kansas State College, 1957

Investigations of interactions of proteins with other substances in solution have shown great promise of giving new information on the physical structure of proteins. Capacity for and intensity of interaction of a protein with small molecular weight substances of known chemical structure, together with any effects upon the protein molecule which occur as a consequence of such interaction, may reflect important features of the structure of the protein. Two methods which have received considerable attention in regard to the interpretation of protein-small molecule interactions are electrophoresis and equilibrium dialysis.

Electrophoresis and equilibrium dialysis were applied to the interaction of certain organic anions with bovine whey protein, namely: methyl orange, Orange I, Orange II, amaranth, and azosulfathiazole. All anions, with the exception of Orange I, conformed to the principle of noninteraction of binding sites. Electrophoretic experiments were carried out at 0.5° C. in veronal buffer at pH 7.7 and acetate buffer at pH 5.5 Phosphate buffer of pH 7.7 and acetate buffer of pH 5.5 were employed for equilibrium dialysis. Equilibrations were made at 0° C. and 25° C.

The manner in which the protein was involved in anion-protein interactions was confirmed with electrophoresis. Presence of anions during electrophoresis of whey protein changes the pattern configuration and mobility. Mobility of all resolved components increased when anions were present for interaction at pH 7.7 and pH 5.5. Relative areas under the peaks developed during electrophoresis of protein-anion complexes and the protein itself were very nearly identical. The most pronounced effect of bound anions on electrophoretic patterns was the disappearance of a peak, namely peak 3. This was noted at both pH levels. Use of veronal and acetate buffers showed that the nature of the buffer was not involved in these effects.

Methyl orange, Orange II, amaranth, and azosulfathiazole interacted with bovine whey protein in such a manner as to demonstrate the presence of similar association constants. This suggests that all binding sites are chemically identical and that they are sufficiently separated from each other to minimize electrostatic interaction between them. The interaction of Orange I with whey protein was described by a sigmoid isotherm; this isotherm was made up of an exponential segment, a linear interval, and a logarithmic phase.

Electrophoretic patterns appear to implicate lactalbumin as an entity in anion-protein complex. Amino acids containing free basic groups are of paramount interest in this investigation due to the fact that anionic binding agents were applied. Basic residues in side chains of lactabumin are one arginine, three histidine, and twelve lysine. Discounting the behavior of multivalent anions and Orange I considered in the current study, results obtained for methyl orange and Orange II point to basic groups of lysine as focal points for interaction.

Electrostatic attraction may be chiefly responsible for the negative ΔF of binding. However, effects of the electrostatic contribution may be equaled or even exceeded by van der Waal's component. In addition, the effect of both of these attractive forces also may be modified markedly by work required to remove part of the solvation mantle of protein. Such reasoning as this may explain the differences in intrinsic binding affinities and binding energies encountered on comparison of such molecules as methyl orange and Orange II or methyl orange and amaranth. Enthalpies of binding are generally negative, and the change in entropy is strongly positive. Positive entropy may be explained by the release of water from hydrated ions and/or displacement of solvent during binding of anions.

130 pages. $2.00. Mic 57-3066

A STUDY OF THE RELATIVE STABILITIES OF SOME COORDINATION COMPOUNDS OF BORON TRIFLUORIDE AND DIBORANE

(Publication No. 22,248)

Alfred Colton Boyd, Jr., Ph.D.
Purdue University, 1957

Major Professor: Herbert C. Brown

The heats of reaction, in nitrobenzene solution of several tertiary amines with boron trifluoride have been determined. The amines were so chosen that the electrical effects would be approximately equal in all cases. This series consisted of the following amines (the negative of the heat of reaction in kcal. per mole is given after each amine): N-methyldiethylamine, 36.0; N-methylpyrrolidine, 37.3; N-methylpiperidine, 36.1; triethylamine, 35.7; N-ethylpyrrolidine, 35.8; N-ethylpiperidine, 35.0; quinuclidine, 40.4.

The marked differences in electron donating ability is explained on the basis of the various steric requirements of the bases.

A supplementary bonding, which enhances the stability of the classical sigma bond, has been advanced to explain the unexpected stabilities of some borine adducts. To determine if this occurs in the pyridine-borine molecule, an appropriate series of amines was chosen. The heats of reaction, in nitrobenzene solution, of these amines with diborane and boron trifluoride were determined. The latter acid cannot be involved in this supplementary bonding. If the pyridine-borine molecule involves some enhanced stability, it should be reflected in a higher heat of formation. By comparison of the results shown below, it was concluded that, if supplementary bonding is involved in the pyridine-borine molecule, it is only of minor import.

Heat of Reaction of $BX_3(g)$ with Amine (sol'n)

	$-\Delta H$(kcal. mole^{-1})	
Amine	1/2 B_2H_6	BF_3
$N(CH_3)_3$	21.8	38.2
$N(C_2H_5)_3$	21.0	35.7
$N(C_2H_4)_3$ CH	25.2	40.4
N C_5H_5	19.1	33.0

98 pages. $2.00. Mic 57-3067

THE EQUILIBRIA OF CRYSTALLINE GALLIUM OXIDE MONOHYDRATE IN DILUTE SOLUTIONS OF PERCHLORIC ACID AND SODIUM HYDROXIDE AT 25°C.

(Publication No. 20,195)

Neil Ross Fetter, Ph.D.
University of Oregon, 1957

Adviser: D. F. Swinehart

The purpose of the present work is to measure the solubility of crystalline gallium oxide monohydrate (GaOOH) in water and dilute solutions of perchloric acid and sodium hydroxide. From the data obtained it is possible to calculate the equilibrium constants and standard free energy changes for the reactions which occur in these media. By employing results from the chemical literature it is possible to expand considerably the number of equilibrium constants which may be obtained from the present research.

The experimental procedure which is described fully in the text of the thesis consists of equilibrating solid gallium oxide monohydrate with varying concentrations of the solutions noted above, permitting the solid to settle, and analyzing the resulting solutions for the total gallium content. A method for the analysis of gallium which consists of titrating gallium ion with potassium ferrocyanide by means of a dead-stop end point apparatus was devised for this work. A colorimetric method employing 8-hydroxyquinoline is adapted from the literature for the analysis of very small quantities of gallium which could not be determined by the dead-stop method.

From the data gathered in this work the reaction

$$GaOOH(s) + 3\ H^+ = Ga^{+++} + 3\ H_2O,$$

which occurs in dilute perchloric acid, is found to have an equilibrium constant of 800 and a standard free energy change of -4000 cal. By using results given in the literature (R. Fricke and K. Meyring, Z. anorg. u. allgem. Chem., 176, 325 (1928)), the equilibrium constants and free energies of reaction for the following reactions are determined

$$GaOOH(s) + H^+ = Ga(OH)_2^+$$
$$GaOOH(s) + 2\ H^+ = GaOH^{++} + H_2O$$
$$GaOOH(s) + H_2O = Ga^{+++} + 3\ OH^-$$
$$GaOOH(s) + H_2O = GaOH^{++} + 2\ OH^-$$
$$GaOOH(s) + H_2O = Ga(OH)_2^+ + OH^-$$

The dissociation constant of water is also needed to calculate the constants for the last three equations above. The equilibrium constants for the above reactions are respectively 7×10^{-4}, 2.0, 8×10^{-40}, 2×10^{-28}, and 7×10^{-18} and the standard free energy changes are 4300, -410, 53,000, 38,000, and 23,000 cal.

By employing a different result given in the literature (T. Moeller and J. L. King, J. Phys. and Colloid Chem., 54, 999 (1950)), different values for the constants of reactions

$$GaOOH(s) + 2\ H^+ = GaOH^{++} + H_2O$$

and

$$GaOOH(s) + H_2O = GaOH^{++} + 2\ OH^-$$

are calculated. The equilibrium constants are 0.33 and 3.3×10^{-29}, respectively, and the standard free energy changes are 650 and 39,000 cal.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

The data gathered from the alkaline equilibrations indicate that the following reaction

$$GaOOH(s) + OH^- = GaO_2^- + H_2O$$

is the only one occurring over the range of base concentrations covered in the experiments (up to 0.05 m). The equilibrium constant is 2.16 and the standard free energy change is -460 cal. By using the dissociation constant for water, the constant for the reaction

$$GaOOH(s) = GaO_2^- + H^+$$

is calculated. The equilibrium constant is 2.16×10^{-14} and the standard free energy change is 18,600 cal.

The water solubility of gallium oxide monohydrate is found experimentally to be 4.5×10^{-7} m. From evidence gathered in this research, it appears that gallium oxide monohydrate dissociates in water as an acid by the reaction

$$GaOOH(s) = GaO_2^- + H^+$$

and not as a base. The ionization constant for this reaction is calculated to be 2.16×10^{-14}. Because the first basic ionization constant is so much smaller than this value, the first acid ionization constant written above is also the true solubility product constant. The corresponding water solubility calculated from this value is 1.5×10^{-7} m, which is considered to be more reliable than the experimental value quoted above.

70 pages. $2.00. Mic 57-3068

POLAROGRAPHY IN NON-AQUEOUS SOLVENTS: I. POLAROGRAPHIC DETERMINATION OF POTASSIUM. II. AMPEROMETRIC TITRATION OF THE TETRAPHENYLBORATE ION. III. REDUCTION OF ALIPHATIC NITROALKANES.

(Publication No. 21,281)

Arthur Frederick Findeis Jr., Ph.D.
Purdue University, 1957

Major Professor: Thomas De Vries

I. Polarographic Determination of Potassium

A recording polarograph was used to obtain polarograms of potassium tetraphenylborate III dissolved in N, N'-dimethylformamide with tetrabutylammonium iodide as the supporting electrolyte. The wave heights were proportional to concentration over the range 0.0002 to 0.0075M which corresponded to 0.08 to 3.0 mg. of potassium in the polarograph cell. The half-wave potential was -1.55 volts versus a mercury pool as a nonpolarized electrode.

II. Amperometric Titration of the Tetraphenylborate Ion

Potassium tetraphenylborate dissolved in acetonitrile-water mixtures can be titrated with a high degree of precision. The method utilizes a dropping mercury electrode as an indicator with a mercury pool as a nonpolarized reference electrode at a potential of -0.1 volt versus the pool. The procedure is suitable for quantities of potassium between 1 and 20 mg. but could easily be extended to higher amounts. The precision and accuracy compare well with other methods for potassium in this concentration range. Dimethylformamide and methyl carbitol were also used in the solvent system but both yielded results that were up to 6 per cent high.

III. Reduction of Alphatic Nitroalkanes

A study was conducted on the kinetic interpretation of the polarographic waves for nitromethane and 2-methyl-2-nitropropane in methanol, ethanol, isopropanol, and tertiary butanol. The rate constants and n values were calculated using the method of Koutecky[1] in which the growth of the mercury drop is considered in the treatment for linear diffusion. The variation of diffusion current with the square root of the height of the mercury column clearly indicated the obeyance of the system to the theory of irreversible polarographic waves. The ratios of i_{av}/i_{max} are given for each system. Viscosity considerations indicate that strong hydrogen bonding exists between the solvent and the nitrocompounds. A mechanism is indicated which is compatable with the results of previous workers.

188 pages. $2.45. Mic 57-3069

1. J. Koutecky, Collection Czechoslov. Chem. Commun. 18, 597 (1953).

KINETICS OF DIOL BRIDGE FORMATION AND DECOMPOSITION IN CHROMIUM HYDROXY COMPLEXES

(Publication No. 22,145)

David Morris Grant, Ph.D.
University of Utah, 1957

Chairman: R. E. Hamm

The aging process which occurs in chromium(III) solutions is generally believed to involve the formation of ol and diol bonds. The change in the absorption spectrum of hydroxodioxalatoaquochromate(III) with time showed that it was possible to study the kinetics of diol-bridge formation by this means. With this compound the reaction is limited to the formation of a dimer, since four coordinate positions of chromium are occupied by the oxalates.

The results of this investigation showed the reaction to be first order in chromium at concentrations greater than 0.01 molar. The reaction showed an apparent induction period which was more pronounced at low concentrations and temperatures.

A mechanism is proposed which is entirely consistent with the experimental data. The rate controlling first-order step is the dissociation of a water molecule from the hydroxodioxalatoaquochromate(III) ion. The induction period and the deviation of the reaction from first-order kinetics at low concentrations are satisfactorily explained by the mechanism proposed.

The temperature dependence of the reaction was studied and gave a value for the heat of activation which was comparable to values obtained by other workers for the dissociation of a water molecule from chromium.

A kinetic study was made of the acid decomposition of the dimeric compound, tetraoxalato-μ-μ-dihydroxodichromate(III), formed in the preceding dimerization reaction. Standard conductivity methods were used in following this decomposition.

The results of this investigation showed the overall reaction to consist of a rapid acid-association equilibrium followed by a successive-rate mechanism. The first of the two successive steps was fitted by a first-order law for all initial concentrations. The second rate-controlling step was found to follow a first-order expression only if the amount of acid was equivalent to or greater than the amount of the chromium dimer present. Otherwise, the second rate was first order in chromium and inverse first order in hydrogen ion.

A specialized conductance bridge was designed to obtain data for the second slow step in a form which could be directly interpreted by the Guggenheim method.*

A mechanism consistent with the experimental data is proposed for the decomposition reaction. The rate controlling step is an ol group dissociation reaction for each of the three reactions.

The temperature dependence of the reactions was studied yielding reasonable values for the heats of activation. 84 pages. $2.00. Mic 57-3070

*E. A. Guggenheim, Phil. Mag., (7) 2, 538 (1926).

ACTIVITY COEFFICIENTS OF ELECTROLYTES IN MIXED AQUEOUS SOLUTIONS

(Publication No. 22,113)

Virgil Fortune Holland, Jr., Ph.D.
University of South Carolina, 1957

An investigation has been conducted to determine activity coefficients of the electrolytes in several mixed aqueous solutions by means of (I) electromotive force measurements and (II) isopiestic measurements.

I. Activity coefficient ratios of acid to salt were evaluated for the two aqueous systems: sulfuric acid – cupric sulfate and perchloric acid – cupric perchlorate by means of electromotive force measurements of type cells: glass / HA (m_1), MA (m_2), M. These ratios were determined as a function of the total ionic strength for six different values of the ratio m_1/m_2 ranging from 8.0 to 0.3. The problems involved in Part I included the construction of copper electrodes with reproducible potentials and the evaluation of the standard potentials of the glass and copper electrodes. The results obtained for the activity coefficient ratios are consistent with the behavior expected of electrolytes of the valence types studied. Attempts to obtain results for two other systems involving copper salts and the corresponding acids, namely, nitric acid – cupric nitrate and hydrochloric acid – cupric chloride, proved unsuccessful due to extraneous chemical reactions occurring in the cells.

II. Individual activity coefficients of each electrolyte in two mixed aqueous three-component systems were evaluated from isopiestic measurements by means of recently devised mathematical expressions. These systems were p-toluenesulfonic acid – sodium p-toluenesulfonate, and p-xylenesulfonic acid – sodium p-xylenesulfonate. Activity coefficient ratios of acid to salt were determined for a mixture of the above two systems composed of 80 per cent p-toluenesulfonic acid and 20 per cent p-xylenesulfonic acid. The results show no simple relation between the activity coefficient of one electrolyte in the presence of another and the total ionic strength, as has been the case for a few other systems of strong electrolytes.

Previously undetermined osmotic and activity coefficients of three electrolytes – ethylbenzenesulfonic acid, p-xylenesulfonic acid, and ammonium p-toluenesulfonate – are also given. 97 pages. $2.00. Mic 57-3071

STUDIES IN MOLECULAR STRUCTURE (PARTS I AND II)

(Publication No. 21,290)

Philip Alan Kinsey, Ph.D.
Purdue University, 1957

Major Professor: Walter F. Edgell

The microwave spectrum of CF_2CD_2 was observed in the region from 19,000 to 34,000 Mc. Fifty-four lines were seen in the rotational spectrum. The spectrum was analyzed and 15 lines were identified. The principal moments of inertia obtained from the spectrum were $I_A = 79.231 \times 10^{-40}$ gcm^2, $I_B = 93.332 \times 10^{-40}$ gcm^2, $I_C = 172.798 \times 10^{-40}$ gcm^2. $\triangle$, which is defined as follows: $\triangle = I_C - (I_A + I_B)$, is .235. This small deviation from a planar model is due to zero point vibrations.

The microwave spectrum of CF_2CHD was observed in the K-band region. Eighty-nine lines were measured. The spectrum was analyzed and 19 lines were identified. The principal moments of inertia obtained from the spectrum were: $I_A = 76.791 \times 10^{-40}$ gcm^2, $I_B = 87.904 \times 10^{-40}$ gcm^2, and $I_C = 164.957 \times 10^{-40}$ gcm^2. $\triangle = .262$.

The moments of inertia of CF_2CHD and CF_2CD_2 were combined with know moments of CF_2CH_2 to obtain the following parameters: $\angle FCF = 109^\circ 15' \pm 25'$, C-F = 1.321 + .005Å, C-C = 1.311 ± .005Å, and C-H = 1.10 ± .05Å. These parameters were calculated assuming an HCH angle of 120° and a CD distance of CH distance minus .009Å.

The microwave spectrometer originally constructed in this laboratory has been redesigned. A detailed description of the equipment and operating instructions for the spectrometer are given. 105 pages. $2.00. Mic 57-3072

POLAROGRAPHY OF URANIUM

(Publication No. 22,274)

David John McEwen, Ph.D.
Purdue University, 1957

Major Professor: Professor Thomas De Vries

Three types of burets were used for storing and dispensing uranium(IV) stock solutions in the study of the polarography of uranium(IV). The only completely satisfactory buret was a sealed buret, which is proposed for titrants requiring an inert atmosphere. This buret requires no attention and may be used frequently or left idle for long periods. Quadrivalent uranium in only moderately acidic solutions (0.1 M) has been kept completely stable in this buret for many months.

The polarography of uranium(IV) has been studied. The effect of pH on the half-wave potential of the anodic wave has been determined in non-complexing (perchlorate, chloride, and sulfanilate-buffered) and complexing (formate, acetate, and monochloroacetate) media. The diffusion current constants of uranium(IV) in formate, acetate and monochloroacetate have been determined as 2.7, 2.2, 2.0, respectively. Using the anodic wave to detect the endpoint, and amperometric method for determining fluoride in formate buffer of pH 3.5 to 3.8 is given, for which the F/U ratio is 2. With all three buffers 2 - 109 x 10^{-6} mole of fluoride has been determined.

The data of six independent investigations on the polarography of uranium(VI) were used to calculate a value of the diffusion coefficient by means of the corrected form of the Ilkovic equation. For the capillary characteristics of the dropping mercury electrode, $m^p t^n$, excellent agreement of the polarographic data was obtained for values of p and n of 0.638 and 0.196 respectively. The diffusion coefficient was also calculated from chronopotentiometric and equivalent conductance data, and for the three methods a value of (5.3 ± 0.2) x 10^{-6} $cm.^2$/sec. was obtained.

The uranium(VI) and (V) polarographic waves were studied in chloride and perchlorate supporting electrolytes of 0.1 M to almost neutral acidities and containing 0 to 100 fold excess of fluoride. The concentrations of the uranium (VI)-fluoride species ($UO_2F_n^{+2-n}$, n = 1 - 4) were calculated and it is shown that the first two species, UO_2F^+ and UO_2F_2 are either reduced reversibly at the d.m.e., or dissociate rapidly to the uncomplexed ion, UO_2^{++}, which is known to reduce reversibly. The $UO_2F_4^=$ specie, and possibly also $UO_2F_3^-$, is reduced irreversibly, and the rate constant of the electron transfer process, k_f^i, and the transfer coefficient, α, were calculated by two methods. The electrode reaction is proposed as $UO_2F_n^{+2-n} + e^- = UO_2^+ + nF^-$. The rate of disproportionation of uranium(V) was found to depend upon the F/U ratio, and the rate constants for the reaction were calculated.

217 pages. $2.85. Mic 57-3073

REACTIONS IN CONCENTRATED SULFURIC ACID

(Publication No. 22,275)

David Gerald Mehrtens, Ph.D.
Purdue University, 1957

Major Professor: Warren W. Brandt

Hammett Acidity Functions for H_2SO_4

An examination of the theories underlying the Hammett acidity functions reveals that the behavior of a protonated compound is dependent on the "effective" charge of the protonated group, rather than on the overall charge of the molecule. Thus a molecule containing reactive groups X and Y differing in charge will have one "activity" with respect to reactions of X and another "activity" with respect to reactions of Y. The simple definition of "activity" commonly applied to the ions of inorganic acids and salts is therefore inadequate in the case of large organic molecules. Furthermore, resonance interactions may greatly alter the "effective" charge of the reactive group, thus causing deviations from the "ideal" behavior defined by the Hammett acidity functions. It is shown that picric acid and 2,4,6-trinitro-m-cresol, while niminally H_- indicators, behave nearly the same as Hammett's H_o indicators. In contrast, the behavior of such true H_- indicators as benzenesulfonic acid and p-toluenesulfonic acid in H_2SO_4 is far different from the H_o functions.

Phenols and Naphthols in Concentrated H_2SO_4

By means of H_- estimates, the spectral changes of sulfonated phenols are correlated with the ionization of their sulfonic acid groups. It is thus shown that simple phenols such as p-cresol, p-bromophenol, and 2,4-dimethylphenol are sulfonated but not protonated in 96% H_2SO_4. Although 2,3,5-trimethylphenol was protonated rather than sulfonated, the reaction occurring in 60-91% H_2SO_4 did not appear to involve the phenolic group.

Complexes of Ti(IV), Nb(V), Ta(V), and W(VI) with Phenols in Concentrated H_2SO_4

Ti(IV), Nb(V), Ta(V), and W(VI) form intensely colored, highly dissociated complexes with phenols and naphthols in concentrated H_2SO_4. While Ti(IV) and Ta(V) form only equimolar complexes with monohydroxyphenols, Nb(V) and W(VI) react with either one or two phenolic groups, depending on the concentrations involved. Those organic compounds containing groups which increase the electron density at the phenolic position are the better reagents for the spectrophotometric determinations of the above metal ions. Mutual interferences of these metal ions may occur.

The effect of the H_2SO_4 concentration on the stability of Ti(IV) and Nb(V) complexes is described. The formation of Ti(IV) complexes is shown to be analogous to the protonation of a neutral base.

Ionic Species of Ti(IV) and Nb(V) in Concentrated H_2SO_4

The above data are used in conjunction with the ultraviolet absorbance spectra of Ti(IV) and Nb(V) in H_2SO_4 in order to draw conclusions about the nature of the ionic species. The Ti(IV) species absorbing at 250 mu in 96% H_2SO_4 is probably either $Ti(OH)(HSO_4)_3(H_2SO_4)_2$, $Ti(OH)(HSO_4)_3$, or perhaps $Ti(H_2O)(HSO_4)_4(H_2SO_4)$. Similarly, $Nb(OH)(HSO_4)_5^-$ and $Nb(OH)_2(HSO_4)_4^-$ are possible forms of the Nb(V) species existing in 96% H_2SO_4.

315 pages. $4.05. Mic 57-3074

THE INTERACTION OF AROMATIC HYDROCARBONS WITH PROTONIC AND METALLIC HALIDES

(Publication No. 22,276)

John Joseph Melchiore, Ph.D.
Purdue University, 1957

Major Professor: Herbert C. Brown

Henry's law constants as well as heats of solution for hydrogen chloride and hydrogen bromide in n-heptane and in 0.5 M solutions of benzene, toluene, m-xylene and mesitylene, using n-heptane as solvent, were determined at -78.5°, -63.5° and -45.2°C. The results indicate that a 1:1 complex is formed between the hydrogen halide and the aromatic constituent in solution at these temperatures.

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Equilibrium constants, ΔF°, ΔH° and ΔS° for the reaction.

$$ArH{\cdot}HX\ Complex_{(sol'n)} \rightleftharpoons ArH_{(sol'n)} + HX_{(sol'n)}$$

have been calculated at each temperature. The following order of increasing stability of the complexes has been established

Benzene < Toluene < m-Xylene < Mesitylene
Hydrogen Bromide < Hydrogen Chloride

A quantitative measure of the base strengths of the mentioned aromatics has also been determined. Presumably these complexes are π complexes involving an interaction between the proton of the hydrogen halide and the π electrons of the aromatic molecule to form a weak hydrogen bond. A linear relation between the ionization potential of the aromatic and ΔF° for the dissociation reaction was found to exist for each hydrogen halide, in accordance with existing theory.

The solubilities of boron trifluoride and boron trichloride in n-heptane and in 0.5 M solutions of benzene, toluene, m-xylene and mesitylene were determined at -78.5°, -63.8° and -45.4°C. The results indicate that no complexes are formed between the boron trihalides and the aromatic hydrocarbons in solution.

The interaction of antimony trichloride with benzene and toluene has been investigated from 0 to 18°C. by using vapor pressure-composition phase studies in conjunction with molecular weight determinations based upon vapor pressure lowering. A solid complex involving an aromatic to antimony trichloride molar ratio of 1:2 is observed, with benzene. However, the solute species involve both the 1:2 and 1:1 complexes. With toluene, solid 1:1 and 1:2 complexes are observed, with the solute being exclusively the 1:1 complex. Molecular weight determinations of antimony trichloride in carbon disulfide indicate the possible existence of an equilibrium between monomeric and dimeric antimony trichloride.

Vapor pressure-composition phase studies as well as molecular weight studies have been carried out on the gallium trichloride aromatic system from 0° to 18°C., using a spectrophotometric method to measure low vapor pressures. The results are as follows. A solid complex having a molar ratio of aromatic to gallium trichloride of 1:2 is formed with benzene, and this complex exists as the solute species in excess benzene. A liquid 1:2 complex is exhibited by toluene, with the complex being the solute in excess toluene. With m-xylene, the phase diagram shows the formation of at least one liquid complex of uncertain composition. From molecular weight studies, an equilibrium between 1:1 and 1:2 m-xylene-gallium trichloride complexes is indicated. Solid 1:1 and 1:2 complexes are found with mesitylene, with both complexes present in dilute solution. These complexes are presumed to be π complexes, with the π electrons of the aromatic nucleus interacting with the metal halide to form the complex.

From the present results and existing literature data, the following order of reactivity has been found for a series of metallic halides in their interaction with aromatic molecules.

$$SbCl_3 > SbBr_3 > AlBr_3 > GaCl_3 > GaBr_3 \gg BF_3 \cong BCl_3$$

Several factors seem to contribute to the observed order of reactivity, these being (1) steric effects, (2) availability of d orbitals in the metal halide, (3) dipole moment, (4) screening effects. However, an all encompassing theory for the observed facts is lacking.

320 pages. $4.10. Mic 57-3075

THERMAL DECOMPOSITION OF FLUORINE NITRATE

(Publication No. 22,187)

William Eugene Skiens, Ph.D.
University of Washington, 1957

Fluorine nitrate was prepared by the reaction of fluorine with potassium nitrate at room temperature. The gas as prepared was quite pure. Fluorine nitrate is relatively unstable and explosions occurred frequently.

The thermal decomposition was studied first in Pyrex-glass, but reaction with this vessel necessitated a change to a reaction vessel which contained no silicon. Reactors constructed of aluminum proved to be satisfactory and were used throughout the major part of the work. The decomposition was studied over the temperature range, 80° to 107°C., and at pressures from 2 to 240 mm. of mercury.

The products of thermal decomposition in aluminum were nitryl fluoride and oxygen. The pressure rose to 1.5 times the initial reactant pressure at the completion of the reaction. The stoichiometry of the decomposition from this pressure rise and the products corresponds to the following equation,

$$NO_3F \longrightarrow NO_2F + \tfrac{1}{2}O_2$$

The reaction is first order and homogeneous under the conditions of the study. It appears to contain a unimolecular step which probably is complicated by subsequent more complex steps. The effect of initial reactant pressure on the rate was studied and the rate was found to fall-off with decreasing initial reactant pressure as predicted by unimolecular theory. Inert gases, added to the reactant, increased the rate in the fall-off region.

The effect of surface on the rate of decomposition was observed by packing a reactor with aluminum turnings. The packed reactor had a surface area 7.3 times that of the unpacked reactor and an area to volume ratio 12 times the unpacked. Runs made simultaneously in both reactors showed no significant effect of surface.

Pronounced effects on the rate were caused by the addition of some gases. No added gas inhibited the rate, however, and no induction period was ever observed. The reactant exploded on contact with nitric oxide at room temperature. Nitrogen dioxide increased the rate markedly. Hydrogen, fluorine, and carbon monoxide also increased the rate, but to a lesser extent than nitrogen dioxide.

The values for the rate constant at infinite pressure were determined and from these values an activation energy calculated. The expression for the rate constant is,

$$k_\infty = 5.80 \times 10^{13} \exp(-29{,}700/RT)\ sec.^{-1}$$

The proposed mechanism for the decomposition is fairly simple, although the steps subsequent to (1) are probably more complex than indicated by the following equations:

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$$NO_3F \longrightarrow NO_3 + F \quad (1)$$

$$NO_3 + NO_3 \longrightarrow 2NO_2 + O_2 \quad (2)$$

$$M + NO_2 + F \longrightarrow NO_2F + M \quad (3)$$

The slow or rate determining step is assumed to be (1). The subsequent steps are all relatively fast and of low activation energy as compared to (1).

Assuming (1) to be the rate determining step, the value of 29.7 kcal. obtained for the activation energy may be attributed to the strength of the oxygen-fluorine bond in fluorine nitrate. 79 pages. $2.00. Mic 57-3076

QUANTUM MECHANICAL CALCULATIONS ON TRIATOMIC HYDROGEN

(Publication No. 22,150)

Richard Lewis Snow, Ph.D.
University of Utah, 1957

Chairman: Henry Eyring

The H_3 system has been studied in terms of a more general wave function than has previously been used. For a linear symmetrical system the screening constant associated with the central nucleus is allowed to vary independently of the internuclear distance and the screening constant associated with the outer nuclei. Three of the three center integrals occurring in the matrix components and the exchange integral between central and outer nuclei were coded and computed on SWAC. Methods for the remaining two three center integrals are discussed and these integrals computed for a single set of parameter values. Making use of distance normalized approximate values for three integrals and exact values for the remainder of the integrals. The energy is minimized with respect to the parameters. The "exact" energy is calculated for the best set of parameter values. The best binding energy (68.0 kcal) is slightly greater than the "best" obtained for equal screening parameters associated with all nuclei. It is concluded that either the use of approximate integrals for such a minimization is not accurate or the wave function itself is not a good description of the system with the second conclusion being favored by the results. Suggestions are given for improving the wave function in order to obtain results agreeing more closely with experiment.

98 pages. $2.00. Mic 57-3077

STUDIES IN MOLECULAR SPECTROSCOPY. THE VIBRATIONAL SPECTRA OF CF_3CD_3, CF_3CH_2D AND CF_3CD_2H.

(Publication No. 18,887)

Heino Susi, Ph.D.
Purdue University, 1956

Major Professor: Walter F. Edgell

Methods have been devised to prepare CF_3DC_3, CF_3CD_2H and CF_3CH_2D. The infrared spectra of the gaseous compounds and the Raman spectra of the liquid materials have been determined. The observed frequencies have been assigned to the fundamental vibrations and overtones and combinations thereof. The assignments of fundamental vibrations for CF_3CD_3 have been considered in the light of coupling between fundamentals associated with motions of the CF_3 group and the CD_3 group. 124 pages. $2.00. Mic 57-3078

FLAME PROPAGATION, THE RANDOM WALK OF CHEMICAL ENERGY; AND OXIDATION STUDIES IN TOLUENE AS A CARRIER GAS

(Publication No. 22,003)

Lowell George Tensmeyer, Ph.D.
University of Utah, 1957

Supervisor: Henry Eyring

Section I.

A new approach to the theory of burning velocity is presented in which a flame front moves forward at a rate determined by the random walk of chemical (potential) energy. The flame velocity is determined by the value of n which is a collision rate divided by a reaction rate, both determined at the point of maximum reaction velocity. The comparison between theoretical and experimental flame velocities is given for cases in which the chemical kinetics are quite well understood. Empirical activation energies for reaction are given for certain hydrocarbon flames. It is hoped that these may be useful in determining the important chemical processes in hydrocarbon flame-propagation.

Section II.

The attempt was made to study the initiation reactions of hydrocarbon oxidation by utilizing a toluene carrier-gas technique. A vacuum system for toluene purification was described. A more complex vacuum system adequate for study of the oxidation processes was also described, with suggestions for refinement of equipment for future work. An infrared technique utilizing solid K Br was adapted for the study of combustion products. Chemical titrations were also used for total acids and total peroxides.

The results showed that the toluene carrier-gas technique will not yield unquestionable data in oxidation systems. This is due partly to further reactions of the benzyl radical. Applied to the formaldehyde-oxygen reaction some of the radicals produced, apparently CHO and CHO_3, do not react quickly and quantitatively with toluene. The method yielded data from which the rate of the initiation

reaction HCHO + O_2 could be calculated for the first time. The value of this constant, $5 \times 10^4\ T^{1/2}\ e^{-39,000/RT}$, must be received with caution, because of further reactions of the benzyl radical.

Benzyl hydroperoxide, benzyl alcohol, benzaldehyde, and bibenzyl were also found as products. The determination of the hydroperoxide in particular gives support to the hydroperoxidation theory of hydrocarbon autoxidation. Predominance of benzaldehyde over benzyl alcohol and benzyl hydroperoxide as temperature increased, was shown to reflect the decreasing stability of the benzyl peroxy radical in the range 400-550°C.

89 pages. $2.00. Mic 57-3079

THE PRECIPITATION MECHANISM OF LEAD SULFATE

(Publication No. 22,480)

Bartholomeus van't Riet, Ph.D.
University of Minnesota, 1957

Adviser: I. M. Kolthoff

The relation between supersaturation and properties of resulting precipitates was determined by rapid mixing of solutions of various alkali sulfates or sulfuric acid with well stirred solutions of lead perchlorate or lead nitrate. The deviation from mean particle size was small in experiments in which precipitation was carried out from stirred solutions in a polyethylene beaker. Slow mixing of the reactant solutions, use of a glass beaker, and precipitation in non-stirred solution caused greater deviation from mean size. The size was critically dependent upon the p_H of the of the precipitating medium at P_H values above 3.2. Most of the experiments have been carried out using solutions of p_H 3.0 or less.

Except for mixtures containing potassium a sharply defined maximum in particle length was observed with increase of the initial supersaturation in mixtures equimolar in lead and sulfate. The maximum in particle size was also found using mixtures containing non-equivalent amounts of lead and sulfate. It was found that the maximum in particle size occurs when the product of lead and sulfate activities has a particular constant value. The equilibrium constant for formation of lead sulfate ion pairs from lead and sulfate ions was calculated from solubility data of lead sulfate and from measurements of electrical conductivity in solutions of low supersaturation.

$$Pb^{++} + SO_4^{=} \rightleftharpoons (PbSO_4)_{\text{aqueous solution}} \qquad K_{PbSO_4} = 410 \pm 40 \ (25^\circ C.)$$

The supersaturation at maximum size, if expressed as ${}^a PbSO_4$ (supersaturated solution) / ${}^a PbSO_4$ (saturated solution), was found to be independent of solubility or temperature within experimental limits. The partial free energy of lead sulfate in supersaturated solutions at maximum size was approximately greater by the heat of solution of lead sulfate (3.2 kcal) than the partial free energy of lead sulfate in saturated solution. Indications were obtained that formation of $K_2SO_4.2PbSO_4$ according to the equilibrium

$$2\ K^+ + SO_4^{=} + 2(PbSO_4)_{aq} \rightleftharpoons (K_2SO_4.2PbSO_4)_{aq} \quad (K' = 6.8 \times 10^9 \text{ at } 25^\circ C.)$$

can be related to the deviations in particle size obtained in the presence of potassium. Supersaturation in respect to $K_2SO_4.2\ PbSO_4$ coincided with change in shape of the crystals from rectangular to obtuse angle crosses.

In exchange studies using Pb^{210} and $S^{35}O_4$ the relative degree of perfection of the crystals dropped sharply if precipitated from solutions more supersaturated than those where maximum size crystals were obtained. The rate of exchange was approximately the same with Pb^{210} and with $S^{35}O_4$ under comparable conditions. Surface exchange depended upon the medium in which the radioactive isotope was dissolved. Decrease of the rate of exchange by aging was faster with increase of the sulfate concentration in the aging medium (least aging in solutions containing an excess of lead).

In determinations of induction periods (I.P.) no simple relation between degree of supersaturation and I.P. was found. Most of the particles of lead sulfate were formed at the end of the I.P. The latter fact can be explained by assuming an increasing rate of nucleation during the I.P. In solutions from which rectangular particles precipitated the dependence of I.P. on the concentration of $(PbSO_4)_{aq}$ agreed with a mechanism in which nuclei are formed predominantly by reaction with $(PbSO_4)_{aq}$ at surfaces or edges of particles already formed, thus a heterogeneous process. The I.P. dropped to very small values if the critical supersaturation for maximum size was exceeded. A different mechanism, e.g. homogeneous nucleation by reaction of species in the liquid phase, might become predominant in solutions of high supersaturation.

222 pages. $2.90. Mic 57-3080

PHOTOCHEMISTRY OF THE THIAZINE DYES AND INSTRUMENTATION FOR PHOTOCHEMISTRY

(Publication No. 22,663)

Neil Wotherspoon, Ph.D.
Polytechnic Institute of Brooklyn, 1957

Adviser: Gerald Oster

Although there has been considerable interest in the photochemical properties of the thiazine dyes for bleach-out photography, no systematic study of the photochemistry of these dyes has been made. In this investigation of the fading of the thiazine dyes in solution, some new and unusual reactions were discovered.

It was found that chelating agents like ethylenediaminetetraacetic acid would function as reducing agents in the photoreduction of the thiazine dyes. The product of this reaction was in every respect identical to that obtained by the use of conventional reducing agents. It was concluded that in this case, the chelating agent is actually an electron donor and that it is oxidized in the process.

The photoöxidation of leuco thiazine dyes was found to involve the oxidized form of the reduction-oxidation system. A bright yellow phosphorescence of long duration was observed when the leuco dye was irradiated in rigid media. The photoöxidation reaction was found to be diffusion controlled and a long-lived excited state is believed to be involved.

An unusual light-induced spectral shift of methylene blue when in the presence of polymeric acids was discovered. It was found that this reaction actually occurred in two steps. First, a light-induced binding of the dye to the polymer was found to produce a small spectral shift. Subsequent irradiation in the presence of air resulted in the formation of a purple substance with a bright red fluorescence. This was shown to be identical with thionine, and the reaction is therefore a photoöxidation.

The kinetics of the photoreduction of the thiazine dyes were found to fit the same scheme as that which has been proposed for the fluorescein dyes. Furthermore, the rates of reaction of both the photoreduction and the photoöxidation were reduced by the addition of small quantities of retarders. The best retarder was p-phenylenediamine which was shown to be ten thousand times more effective in quenching the long-lived metastable state than the singlet state. The retardation is shown to involve a diffusion-controlled bimolecular reaction between the dye in the excited state and the quencher. The lifetime of the excited state of methylene blue was estimated from the retardation data to be about 10^{-4} sec.

Direct identification of the long-lived excited state with the triplet state has not been possible in the case of the thiazine dyes. However, in view of the similarity of the kinetics of fading to those of the fluorescein dyes, it is concluded that a triplet state of excitation is involved in the photoreduction and photoöxidation reactions.

It was necessary to design and construct several instruments which were used in this investigation. A recording spectrophotometer for the ultraviolet and visible regions was made from a grating monochromator. It was used for both absorption and fluorescence spectroscopy and for plotting kinetic curves of photochemical reactions. A mechanical phosphoroscope using photographic film was made for phosphorescence lifetimes longer than 10^{-5} sec. A recording densitometer for evaluating the phosphorescence trace was constructed. An electronic lifetime apparatus for both fluorescence and phosphorescence lifetime was designed. It uses an electroöptic light modulator of the Pockels type. For long lifetimes, a rectangular pulse actuates the modulator and the decay of the luminescence is displayed on an oscilloscope. Fluorescence lifetimes were obtained by modulating a light source at 3 megacycles, and measuring the change of phase in the fluorescence emitted by the sample.

154 pages. $2.05. Mic 57-3081

TRANSIENT POTENTIALS DUE TO SURFACE REACTIONS ON A COPPER ELECTRODE, AND MECHANISM OF INHIBITOR ACTION FOR CHAIN PROCESSES

(Publication No. 22,004)

Kang Yang, Ph.D.
University of Utah, 1957

Supervisor: Henry Eyring

Section 1.

One of two copper electrodes is placed in a solution and allowed to reach a steady state of the surface chemical processes in that solution. Then the other electrode is introduced into the solution, and observations are made of the transient potential between these two electrodes which appears as the second electrode reaches the same steady state as the first one. This transient potential builds up first to a certain maximum value, occasionally as high as 200 millivolts, within a few seconds and decays approximately to zero after four minutes. The curve of potential versus time depends, among other things, on the electrode material, the kind of electrolyte used, the pH, and the temperature. Except in one molar HCl solution, the second electrode plunged into various salt solutions acquires a negative potential with respect to the first electrode. The maximum of this negative potential ($-\Delta V_{max.}$) increases sharply through the range of pH, 0 to 3, while it decreases over the pH range of 10 to 14. Between these two ranges, $-\Delta V_{max.}$ increases only slightly with increasing pH. The time, t_o, required to return to the initial instantaneous potential, shown when the second electrode was plunged into the solutions, depends upon the pH in the same way that $-\Delta V_{max.}$ does. The values of $-\Delta V_{max.}$, as well as t_o, are almost independent of cupric ion concentrations, and decrease with increasing temperature.

These experimental results are explained on the basis of the following assumptions: The transient potential is due to two reactions on the surface of copper. One is the dissolution of copper and the other is the reduction of the oxygen which has been adsorbed on the cuprous oxide layer of the metal surface. The former reaction reaches its steady state much more rapidly than does the latter. Based on these assumptions, an equation relating $-\Delta V$ and the time, t, has been derived. The result is:

$$-\Delta V = \frac{E_\infty}{1 - ce^{-\lambda t}}(1 - e^{-\lambda t}) - \frac{E_\infty}{1 - c'e^{-\lambda' t}}(1 - e^{-\lambda' t}) + (E'_\infty - E_\infty) \qquad (1)$$

where, E_∞ and E'_∞ are the electromotive forces for the stationary copper and oxygen electrodes, respectively. c, c', λ and λ' are the constants depending only on the rate constants of various steps in the assumed electrode reactions and on the concentrations of electrolytes in solution. Equation 1 is applicable only when the solutions are dilute. From (1) the time, t_o, is obtained and is discussed in the light of the experimental data. The agreement is satisfactory.

In addition to the copper electrode, the transient potentials for iron electrodes in distilled water and magnesium electrodes in distilled water were also measured. In the case of the system, Fe in distilled water, the general shape of the potential curve versus time is similar to that for the system, Cu in distilled water, while for the system, Mg in distilled water, sharp minima are observed in the plot of $-\Delta V$ against time.

Section 2.

The classical theories concerning the inhibitor action for chain processes attribute the inhibitory action to the reaction, β (or μ) + I → product. Here β is the radical which reacts bimolecularly in the chain propagation steps in the Rice-Herzfeld mechanism, whereas μ is the radical acting monomolecularly; I is the inhibitor, and product indicates the substances which are indifferent from the chain reaction system. Thus, the classical theories explain the inhibitory action by consumption of I. Often consumption

of I is not observed. We propose the mechanism by which I destroys the chain carriers and is regenerated from the bound states, (βI) and (μI). Here (βI) and (μI) are the complexes which are formed by reactions of I with β and μ. Introducing these mechanisms into the Rice-Herzfeld scheme of uninhibited reactions, and applying the steady-state treatment for twelve possible inhibited reaction systems, two equations for r/r_o are obtained in agreement with experiment. Here r and r_o are the rates of the inhibited and uninhibited reactions, respectively. According to our results, r/r_o is smaller if the attraction between chain carriers and I is larger, the consumption of I is smaller, the chain length of the uninhibited reaction is larger, and the reactivities of (βI) and (μI) are smaller (cf. equations (34) and (35) in the test). Our theory is successfully applied for the inhibited decompositions of normal hydrocarbons and diethyl ether by NO and propylene, for the inhibited pyrolyses of aldehydes, ether, and ketones by propylene, and for the inhibition of benzaldehyde decomposition by NO. 125 pages. $2.00. Mic 57-3082

D-arabo-3-HEXULOSE

(Publication No. 22,005)

George Ulysses Yuen, Ph.D.
University of Utah, 1957

Chairman: James M. Sugihara

A relatively new oxidant, chromium trioxide-pyridine may prove to be an ideal oxidizing agent for carbohydrate chemistry. This oxidant is attractive from the point of view that it has little tendency to cleave blocking groups, such as esters and ketals, which are commonly used in carbohydrate chemistry. As evidence, 4-O-benzoyl-1,2:5-6-di-O-isopropylidene-D-arabo-3-hexulose was obtained in 47% yield by chromium trioxide-pyridine oxidation of 3-O-benzoyl-1,2:5,6-di-O-isopropylidene-D-mannitol. This is the first recorded instance that a 3-hexulose derivative with a free carbonyl group has been isolated in crystalline form. The structure of 4-O-benzoyl-1,2:5,6-di-O-isopropylidene-D-arabo-3-hexulose was established by forming its phenylhydrazone, by determination of its infrared spectrum and by its reduction to the expected isomeric di-O-isopropylidene hexitols in 94% yield.

In addition to serving as proof of structure for the ketohexose derivative, the reduction is a new route of synthesis of D-talitol. Approximately 50% of the reduction products was isolated as a new crystalline compound 1,2:5,6-di-O-isopropylidene-D-talitol, which offers the possibility of synthesis of other partially substituted D-talitol derivatives. Hydrolysis of the isopropylidene groups from 1,2:5,6-di-O-isopropylidene-D-talitol yielded crystalline D-talitol, which was converted to the known tribenzylidene derivative.

The hydrolysis of ketal groups catalyzed by a cationic resin, Amberlite IR-120, was studied. 1,2:5,6-Di-O-isopropylidene-D-mannitol and its benzoylated products served as model compounds. Hydrolysis of the isopropylidene-D-mannitol was much faster than from its benzoates. This suggests that the hydrolysis of ketals is governed at least in part by steric factors. A new crystalline compound, 3-O-benzoyl-D-mannitol, was obtained in the course of this study. The use of Amberlite IR-120 instead of dilute mineral acid was found to be advantageous for the hydrolysis of ketal groups from acid-labile molecules. For this reason, the procedure for hydrolysis of ketal groups by Amberlite IR-120 seems very applicable to carbohydrate chemistry.

By careful hydrolysis of the benzoate and isopropylidene groups from 4-O-benzoyl-1,2:5,6-di-O-isopropylidene-D-arabo-3-hexulose, a water soluble sirup was obtained, which was presumed to be D-arabo-3-hexulose. This compound appears to be labile to heat and acids.
56 pages. $2.00. Mic 57-3083

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

ECONOMICS, GENERAL

THE ECONOMICS OF THE ANGLO-IRANIAN OIL DISPUTE

(Publication No. 22,323)

William Bryan, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Paul T. Ellsworth

This thesis is concerned with the problems and issues involved in the development of oil resources in underdeveloped Iran by the Anglo-Iranian Oil Company and the subsequent effects on the social and economic patterns of Persia. An attempt is made to determine whether the Company, in mining oil in Iran for over forty years, furthered its own growth or concerned itself with the economic welfare of that nation.

Iran's resources are first discussed in order to determine her potentialities for economic development. The Persians consider them to be their own, a source of wealth and power which could make Iran rich and prosperous. Yet, these resources are the reason Great Britain, Russia, and the United States vied among themselves for concessions in Iran.

Each oil agreement points out the inherent conflict between Persia and the recipients of the concession--the conflict arising from differences in civilizations and standards of value. Each subsequent accord reflects the changing economic conditions and social patterns in the country which the Imperial Government understood but failed to meet.

The split between Persia and the oil Company became clearer when a few Iranians realized that oil revenues could be effectively used to develop their country. This schism widened when The Tudeh Party stirred the Iranians to the realization that the royalties from Anglo-Iranian were meager compared to those of the Company and the British Government. Some Persians comprehended that their Seven-Year-Plan, prepared by Overseas Consultants, Incorporated, could be fulfilled if oil revenues were increased and aid could be obtained from the United States and international agencies.

To obtain increased royalties meant continual revisions of the original British agreement of 1901 and granting new concessions to the Russians and the Americans. When both these attempts and the Government's own measures failed to provide sufficient capital for economic development, oil nationalization was the only alternative.

Nationalization of Anglo-Iranian created confusion the interpretation of international law. Did the Persian Government have a right to seize in its own country a foreign enterprise whose majority of stock was owned by a foreign government? When the International Court of Justice failed to answer this question, the controversy developed into an endurance test between Persia and Britain.

The controversy pointed out the difference of attitude between the disputants. Both the British Government and the Company approached the matter as a business contract, and felt the the Imperial Government had to fulfill its contractual obligation to the letter. The Persians refused "sanctity of contract," believing that the British used this means to exploit Iran's natural resources.

The most obvious influence the Anglo-Iranian Company had on the Persian economy was financial, both in terms of direct payments to the Iranian Government and indirect spending for the Company's operation activities. Besides being the largest private individual employer, Anglo-Iranian had a general technical impact on the population, housing, education, health and social services.

However, the oil industry, in spite of its tremendous commercial operations, contributed little to the economic development of Iran. The Company employed a small fraction of the country's labor force, and used little of Iran's products which would have helped Persian economic growth. The impact of the social services supplied by Anglo-Iranian benefitted only a relatively few. Oil royalties found their way into the hands of Government officials. Iran's great need was special knowledge and skills required for modern industrial life. Yet, the Company failed to fill this need by not producing enough Persian skilled workers to bring about changes in the industrial structure of the country. Also, Anglo-Iranian did not direct its management in such a way as to intergrate it with the Iranian economy.

All in all, the basic social and economic ills still remain unsolved despite the pronouncements of the Anglo-Iranian Oil Company. 593 pages. $7.55. Mic 57-3084

THE AMERICAN TEXTILE MACHINERY INDUSTRY: AN ECONOMIC STUDY

(Publication No. 21,910)

John V. Craven, Ph.D.
Syracuse University, 1957

The American textile machinery industry is one that derives its economic importance mainly from its role as supplier of manufacturing equipment for one of America's largest industries, textiles. The functions of textile machinery are to transform raw fibers, like cotton and wool, into spun yarn; to weave or knit yarn into cloth; and to "finish" cloth as end use requires.

The manufacture of textile machinery is marked by dominance of a few firms. This dominance takes the form of duopoly in the production of preparatory equipment and monopoly in plain loom, fancy loom, and full fashioned knitting equipment. In other sectors of the industry, such as finishing machine or replacement parts manufacture, there appears to be much less evidence of concentration of output by a few firms.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

The market structure of this industry reflects 150 years, more or less, of economic conditioning, but its present outlines were virtually set prior to World War I.

The Southern textile boom following 1880 had engendered severe competitive stresses, leading to consolidation of several firms and elimination of many others.

The problems of capital-goods industries are especially plaguing for textile machinery manufacturers. The textile industries, particularly cotton, have not been economically well since World War I, excepting the World War II period. The absence of radical or even substantial changes in textile machine technology has intensified deficiencies in demand, and has encouraged competition in the increasingly important market for parts. In the post-1945 decade the dominant firms have begun to seek relief in moving closer to their market--the Southeast--and in diversifying their operations beyond textile machinery manufacture.

Economic changes taking place in this industry provide another illustration of the real vulnerability of oligopoly even when its entrenchment appears very deep.

187 pages. $2.45. Mic 57-3085

CYCLICAL SENSITIVITY AMONG NEW ENGLAND STANDARD METROPOLITAN AREAS--AN EXAMINATION OF CERTAIN HYPOTHESES

(Publication No. 21,939)

Frank William Gery, Jr., Ph.D.
Boston University Graduate School, 1957

Major Professor: Everett J. Burtt, Jr.

Statement of the Problem.--The major thesis is that cyclical sensitivity of New England Standard Metropolitan Areas is a function of any one or a combination of the following variables:

1. specialization in manufacturing industries as opposed to non-manufacturing industries,
2. specialization in durable goods industries as opposed to non-durable goods industries,
3. specialization in a few major "S.I.C. two-digit" manufacturing industries,
4. degree of transition in the structure of manufacturing industry.

Eighteen S.M.A.'s constitute 66% of New England's population and upwards to 90% of important regional economic activities.

Procedure.--In Part I, the comparative cyclical amplitude of business cycles in the United States, New England, and the S.M.A.'s comprising New England is determined for the period following World War II. Three monthly time series are used to describe cyclical characteristics: bank debits, electric energy production, manufacturing employment, as well as a composite of these series called an "Index of Economic Activity." For comparative purposes, cyclical amplitude of an Area is measured as the cumulative fluctuation during all contractions and expansions from 1947 to 1954. In Part II, the major thesis is tested by correlation with the empirical evidence on relative cyclical amplitudes (sensitivity) of the S.M.A.'s disclosed in Part I.

Results.--The New England region suffered 15-20% more cumulative fluctuation of business cycles than the United States during 1947-1954. Most of this extra amplitude resulted from fluctuations up to 1951 or early 1952. After this time, national and regional business cycles were about equal in severity, but considerably reduced in amplitudes of S.M.A. business fluctuations were exceedingly diverse, ranging very low for Boston to very high for Lawrence. Despite individual S.M.A. differences in cyclical timing and amplitude, New England regional movements are the reflection of the aggregate movements of the S.M.A.'s comprising the region. New England turning points represent the central tendency of S.M.A. cyclical timing, and New England amplitude represents the weighted average of the aggregate amplitudes of the various S.M.A.'s.

The pattern of cumulative cyclical amplitude of the S.M.A.'s correlates highly with the degree of "manufacturing specialization" ($r = \not.82$) and "two digit manufacturing specialization" ($r = \not.70$). A multiple correlation of both measures of specialization with cyclical sensitivity shows a better relationship. ($R = \not.89$). The "durable goods specialization" hypothesis proves valid for only nine S.M.A.'s concentrated in "hard-goods" ($r = \not.92$), largely because of the detrimental influence of violent textile industry fluctuation on the "soft-goods" S.M.A.'s. Substantial transitional changes in the industrial structure of an Area also tend to increase cyclical sensitivity.

Conclusions.--The findings suggest three conclusions:

1. New England S.M.A. cyclical sensitivity is a function of concentration in manufacturing in general or specialization in a few major S.I.C. two-digit manufacturing industries. The sensitivity is intensified by specialization in durable goods, specialization in textiles (at least in post-war years), and substantial transition in the structure (composition) of manufacturing industries.
2. New England, by implication, had greater post-war cyclical sensitivity than the United States as a whole because of greater regional concentration in manufacturing in general, greater specialization in "two-digit" manfacturing industries, greater textile specialization, and greater industrial transition than the national economy experienced.
3. Some Connecticut S.M.A.'s should encourage the growth of either non-manufacturing or non-durable goods industries, some Massachusetts S.M.A.'s should encourage growth of non-manufacturing industries, while many S.M.A.'s in both states should gradually diversify their existing industrial base, if they expect to reduce their sensitivity to future business fluctuations.

275 pages. $3.55. Mic 57-3086

APPLICATION OF SOME SAMPLING TECHNIQUES TO IMPROVE THE COLLECTION OF AGRICULTURAL DATA IN EGYPT

(Publication No. 22,362)

Mohammed Kamel Hindy, Ph.D.
The University of Wisconsin, 1957

Supervisor: Asst. Professor Walter H. Ebling

The economic development of Egyptian resources and the discovery of future potentialities depend to a large extent on the availability and accuracy of statistical data. It is the function and responsibility of the statistical authority of the country to provide the policy makers, the research workers, various other groups and individuals with the statistical information needed within a reasonable range of accuracy and at the proper time, if the data are to be useful.

The present system of collecting data in Egypt is becoming obsolete. The traditional method of complete enumeration is used to provide annual data about acreage, production of crops and many other items relevant to the agricultural sector of the economy.

The use of complete enumeration to obtain current data is expensive and time consuming, especially when there are other economical methods available to give adequate and more reliable information about agricultural facts in less time. In addition, the error in complete enumeration is not measurable. It is believed that through the use of relatively economical sampling processes, agricultural data can be greatly improved. Timely estimates can be released from the sample surveys. This thesis deals mainly with the use of sampling to improve the collection of current and census data in Egypt. Because the production of field crops is the backbone of agriculture, more emphasis has been placed on estimating acreages and yields.

The distribution of farms by size groups is highly skewed to the right. The condition is that a large number of holders operate small farms which covers only a small fraction of the cultivated land, while a relatively small number of holders operate large farms which constitute a large proportion of the cultivated area. Reliable acreage estimates can be obtained by dividing the universe into two groups: the group of small farms and the group of large farms. The group of small farms constitutes about three-fourths of the total number of farms in the country and it contributes only to about one-fourth of the total area. Therefore by sampling the group of small farms and enumerating the group of large farms, we are able to obtain more reliable estimates in less time.

The accuracy of yield information under the present system of collecting agricultural data depends on the personal judgement of the local officers of the government and the reliability of information they obtain from farmers. The subjective element in obtaining data introduces a large and unmeasurable bias. Estimates are released late. To improve the accuracy and timing of data, sampling in conjunction with objective methods of estimation were suggested. Selecting sample areas immediately before harvest and objectively measuring yield on these sample areas would promise a good possibility for improving yield estimates.

The noncurrent census data can also be improved in terms of timing and accuracy through sampling. The skewed character of the distribution of farms provides an opportunity to sample the data collected on the small farms and enumerate the large. Thus, we are able to issue preliminary figures early after the census is taken, based on the tabulation of a sample of small farms and the enumeration of all large farms, leaving revisions to be made at a later date. The quality of census data can be improved through the use of sampling to supplement the complete enumeration and to check the census information, but not to supplant the complete and detailed enumeration of the census. 343 pages. $4.40. Mic 57-3087

RICE AND SUGARCANE COMPETITION ON PADDY LAND IN CENTRAL TAIWAN

(Publication No. 22,458)

Sam Chung Hsieh, Ph.D.
University of Minnesota, 1957

Rice and sugarcane are the two most important crops in Taiwan. Competition between them has long been considered an important farm organization problem of individual farmers. This study is made from the viewpoint of maximizing returns to individuals. The purposes of this study are to apply cost and income data to an interpretation of the factors influencing farmers' choice of rice or sugarcane, and to apply the input-output data to an analysis of optimum choice and combination of rice and sugarcane on farms.

The factors in favor of rice over sugarcane are higher returns from rice systems supplemented with winter crops, more opportunity to use family labor, quicker turnover, and family needs. Factors favoring sugarcane are less cash expenditure, availability of credit, encouragement of sugarcane extension agents, and lack of irrigation. Farm size is another factor influencing farmers' choice of sugarcane. The larger the farm, the greater the tendency of the farmer to devote part of the land to plant sugarcane.

The farmers' choice of rice or sugarcane is determined by relative earning capacity of rice or sugarcane, and the relative availability of scarce resources at the farmers' command. The farmer selects an optimum farm organization for efficient use of his resources on the farm as a whole. When a resource is in limited supply and has more than one use, the appropriate rate to charge resource is its opportunity cost. Linear programming provides an effective tool for consideration simultaneously of the opportunity costs of the scarce farm resources and can be applied to this study.

First approximation: Assume that land is the most important limiting factor and capital second, with a possibility that labor is not limited. All sugarcane systems are inferior productive processes requiring more land and capital to produce a given value output in the use of double cropping paddy land. The price of sugar must increase 60 percent over the current level to enable sugarcane to compete with rice in the optimum farm organization. However, in the use of single cropping paddy land, an optimum farm organization involves a

combination of rice and sugarcane cropping systems under the average farm situation.

Second approximation: Assume that selection of winter crops is open to the farmers, labor is included as an additional limiting factor, and the supplies of land and labor are divided into crop seasons. The final optimum organization within the restrictions of assumed resource supplies provides rice production in the major crop season and wheat production in the winter season.

Third approximation: Define more realistically the restrictions of resources under Taiwan's farm situations. Different kinds of land can be defined as different resource categories. The small plot of land can be considered as a unit for a given process. The restrictions of labor supplies in the busy crop seasons can be considered. The farmers' willingness to work longer hours during the busy seasons may be assumed. The capital accruing from the preceding crops and the loans available for crop extension can be included in capital supply. The interchange of capital between farm and family use is also assumed.

Fourth approximation: Consider farmers' requirement of minimum rice production for family food and relative risks in rice and sugarcane production. The minimum rice requirement can be considered by putting this requirement into the simplex table as an additional restriction, and placing a relatively high subjective value on the rice produced for home consumption. Higher risk in sugarcane production can be considered by making an adjustment in the simplex table: the returns from sugarcane can be adjusted by discounting to counter-balance the cost of risk, or putting a maximum limit of acreage for sugarcane as an additional restriction.119 pages. $2.00. Mic 57-3088

EXPECTATIONAL DATA AND SHORT TERM FORECASTING: AN ANALYSIS OF THE SAVING-INCOME RATIO WITH SPECIAL REFERENCE TO THE DEMAND FOR CONSUMER DURABLE GOODS

(Publication No. 21,118)

Francis Thomas Juster, Ph.D.
Columbia University, 1957

Economists have generally paid insufficient attention to the problem of integrating explicitly expectational variables into short-term forecasting models. As a consequence, such forecasts have proved to be notoriously unreliable. The need for "forward looking" data is perhaps greatest when attempting to forecast investment spending but exists also in the area of forecasting expenditures for consumption goods. This category of expenditures is frequently regarded as being completely determined by such factors as current and past real income, liquid assets, etc.

Within this framework, data bearing on consumption expenditures are examined. It is argued that the major reason for instability in the relationship between aggregate real consumption expenditures and current and past levels of real disposable income is that purchases of major durable consumer goods are ordinarily treated as consumption and not as personal investment (and saving). By defining personal saving to include saving in the form of real assets, i.e., expenditures on major durables, we are able to make relatively accurate forecasts of saving (or of consumption expenditures minus purchases of major durables) by use of the above mentioned income variables. Our redefinition of saving and consumption is not only of practical value for purposes of forecasting but has sound analytical roots; aggregate expenditures on the mass of individually small, non-durable consumption items are likely to be relatively insensitive to household attitudes and plans, being determined largely by habitual behavior patterns. The latter in turn are heavily influenced by current and past income levels. The distribution of saving between real and financial assets, on the other hand, is likely to be strongly affected by attitudes and expectations.

Data bearing on household purchases of major durables are examined to see whether adequate forecasts of spending can be made in this area where volatile behavior seems to be prevalent. It is found that purchases during a period are significantly related to the spending plans reported by households at the beginning of the period. The degree of relationship is closer for categories involving more costly items. Two sets of spending plan data were tested against purchases. Data compiled by The Survey of Consumer Finance, conducted by the (Michigan) Survey Research Center, yielded consistently inferior forecasts of household purchases by the population as a whole than did data compiled by Consumers Union of the U.S. (a product testing and rating organization) from a mail questionnaire sent out only to Consumers Union subscribers. Both sets of data showed that the use of explicit spending plans to forecast household purchases of major durables is a subject requiring and deserving further examination.

Further investigations are carried out as regards the joint effect of spending plans and income changes on purchases of durables (assuming the income changes to be unforeseen at the time plans are formulated). This investigation showed that the income variable materially improved the relationship between the Survey of Consumer Finance's spending plans and purchases of the population; inconclusive results were obtained in testing the income variables and the Consumers Union spending plans as joint explanations of purchases for the population as a whole, since the two independent variables turned out to be highly correlated.

The accuracy of forecasts for individual commodities is examined. It is found that the accuracy of these forecasts is positively correlated with the unit cost of the item. Further, the accuracy of the aggregate forecasts is shown to have been built up from a fairly consistent pattern of accurate forecasts for individual items rather than from offsetting errors in the individual items.

An attempt is made to combine the forecasts of saving plus durables with the forecasts of durables in order to obtain an indirect forecast of "liquid" saving. The results are inconclusive, although it appears that the indirect forecasts of saving are slightly better than direct forecasts made in the usual fashion.

356 pages. $4.55. Mic 57-3089

A STUDY OF THE POLITICAL METHODS OF THE AMERICAN LABOR MOVEMENT SINCE THE 'EIGHTIES

(Publication No. 22,378)

William Owen Kuhl, Ph.D.
The University of Wisconsin, 1957

Supervisor: Selig Perlman

The American labor movement in the years, 1881-1955, preferred to protect and promote the welfare of its membership through exercising its economic strength against American industry. While this was true, labor's leadership recognized the importance of governmental decisions and actions. They were often of critical importance to labor. This fact caused the American labor movement to formulate a legislative program and work to secure favorable consideration of it. It regularly adopted legislative demands.

AFL leaders recognized early that labor's legislative demands would receive favorable consideration only if political pressure were exerted in their behalf. Their first form of organized political pressure was that exerted by their standing Legislative Committee. But Congressional refusal to act on labor's demands caused the AFL to reassess its political methods. It in 1906 for the first time urged labor to organize effectively to "Get-Out-the-Vote" for labor's political friends. Labor's political methods from then on were essentially twofold, lobbying and "Get-Out-the-Vote" activities. Prior to 1936 labor tended to emphasize the lobbying activity.

The New Deal and "The Constitutional Revolution of 1937" produced significant changes in the American economic and political system. They resulted in the federal government gaining the right to act effectively in the area of protective and labor relations legislation. Government in the 1930's became an effective force in the economic arena.

Labor did not recognize immediately the critical nature of the new permissible interventionist philosophy of government. Its recognition was not complete until the passage of the Taft-Hartley Act. It forced the labor movement, which charged that this enactment was a threat to its very existence, to reappraise the adequacy of a traditional application of its basic political methods. This reappraisal resulted in the establishment of PAC and LLPE. Their task was to organize political education and political action programs which would cause the rank and file to vote intelligently on Election Day.

PAC and LLPE were indicative of several changes which occurred in labor's political methods. "Get-Out-the-Vote" activities assumed major importance in labor's campaign to exert effective political pressure on government. To stimulate, advise, coordinate and direct labor's activity at getting-out-the-vote, labor's federations established PAC and LLPE. Their tasks were to insure that labor at the "grass roots" organized in support of labor's political friends.

While labor established political arms which inaugurated intensive political education and political action programs, its political methods were still non-partisan in nature. Labor did not deviate from the principle of being partisan to issues and candidate records but non-partisan as regards political parties. In this sense labor's non-partisan political policy first clearly enunciated in 1906 was reaffirmed by both PAC and LLPE.

American labor's political methods, as indicated, changed over the years. This dissertation attempts to record and analyze these changes. In doing so it recognized that labor's political methods were determined experimentally, in response to the needs of the time. Through discussing labor's political methods, labor's role in American political life is analyzed.

389 pages. $5.00. Mic 57-3090

A THEORETICAL AND STATISTICAL ANALYSIS OF CONSUMER INVESTMENT

(Publication No. 22,091)

Walter W. McMahon, Ph.D.
State University of Iowa, 1957

Chairman: Professor Robert H. Johnson

Consumer investment, defined to include consumer expenditures on durables and expenditures on dwellings for owner-occupancy, is a cyclically volatile component of aggregate demand. Its magnitude exceeds all business investment in most years. Consumer investment behaves cyclically in a fashion that is radically different from consumption and is also influenced by different factors.

Separating "outlays on consumption goods" from "consumption," it is demonstrated that there is an inconsistency in the application of the interdependence of preferences hypothesis to consumer investment outlays. The interdependence hypothesis must be interpreted as relevant to the special case where factors associated with consumer capital assets are neutral. Where the consumption of goods is virtually synonymous with their acquisition, little flexibility is available to the consumer in the timing of outlays.

It is shown that the aggregate consumer investment-income ratio is largely independent of the level of income in periods of steadily rising income or in long run analysis. The cyclical consumer investment function has an income elasticity that is greater than unity.

In addition to income, a series of variables are examined theoretically and statistically to appraise their relevance as possible determinants of aggregate consumer investment. The multivariate statistical analyses are concerned primarily with the 1920-1941 period, but data through 1955 and budget study evidence are also examined.

Although consumer investment varies by age group and occupation in budget study data, changes in the age structure of the population and in other variables pertinent to population composition are viewed primarily as secular factors. The positive association of the rate of household formation with the consumer investment-income ratio was not found to be statistically significant.

Consumer stocks of durables and owner-occupied dwellings (measured by the perpetual inventory method) have remained on the average in approximately equal ratio to annual "real" disposable income. Given a cyclical decrease (increase) in income, existing consumer stocks of durable goods and dwellings can exert a depressing (inflating) effect on new consumer investment outlays. In other words, "past demand" makes its influence felt on

present demand through consumer stock levels that carry over into the present period with relative inflexibility. When the relative price of new consumer investment goods is taken into account, consumer capital stock levels relative to income are demonstrated to be significantly related to the consumer investment ratio.

"Real" balance effects, with the possible exception of the immediate postwar years, are found to be insignificantly related to new consumer investment. Indications are that price expectations affecting both liquid asset balances relative to income and the consumer investment ratio significantly override real balance effects. If the existence of a Pigou effect is to be observed empirically, it is suggested that major efforts will have to be devoted to an appropriate treatment of expectations.

Consumer investment credit outstanding relative to income and the relative price of consumer investment items are both found to be related to the consumer investment ratio in a highly significant fashion. Interest rates alone are not significant to consumer investment, but they inadequately reflect the total impact of the length of the repayment period, financing changes, and down payment terms.

It will be noted that cyclical fluctuations in income, in relation to the relatively inflexible "stock" type measures of consumer investment credit outstanding and consumer capital stocks, are capable of producing accelerated changes in new consumer investment outlays. There are indications that consumer capital outlays have greater sensitivity to expectational factors than does consumption, and that changes in the relative price of consumer investment goods do not contribute to the stability of consumer investment. Given the magnitude of consumer investment, one source of economic instability lies within the consumer sector. 435 pages. $5.55. Mic 57-3091

A FINANCIAL ANALYSIS OF INDEPENDENT FOOD STORES IN INDIANA

(Publication No. 22,281)

Eric C. Oesterle, Ph.D.
Purdue University, 1957

Major Professor: R. L. Stucky

Retail food distribution is one of the largest segments of retailing and the most costly operation in the food marketing channel. Improvements in this area may result in substantial benefits to consumers as well as producers of agricultural products.

Approximately two-thirds of the food retailing function is performed by independent operators who lack the resources to undertake programs which would lead to improvements in operating practices and policies in their firms. This group has indicated the need for more detailed information on departmental sales and gross margins, equipment utilization, and labor efficiency to serve as guides in making decisions. This study was designed

1. to formulate statistical standards from operating records which store managers can use to evaluate their operations.
2. to determine the worth of common management practices and policies through a comparative analysis of the operating results of different sizes and types of retail food operations.

Departmentalized income statements, balance sheets, a detailed analysis of labor utilization, and physical measurement data were collected from 86 Indiana independent food stores. Financial statements were adjusted to a single proprietorship basis. Data were classified by sales volume, least and most profitable operations based on the net profit ratio, and by wholesaler affiliation.

The ratio of net profit to sales increased with sales volume. Total dollar investment in assets also increased with increased volume but not at as rapid a rate. The larger stores obtained a higher percentage return on total investment as a result of both a high net profit ratio and a high rate of capital turnover.

The grocery and meat departments accounted for approximately 78 percent of total sales volume and were the principal determinants of the total gross margin percentage. Total gross margins remained relatively constant for all sales volume classifications. However, the grocery department sales increased as a percentage of total sales with size of store due to the addition of more non-food and other specialty items. Dairy departmental sales declined as a percentage of total sales as sales volume increased.

The larger operations made more efficient use of labor, store areas, and equipment. Sales per man hour, sales per square foot of selling area, and sales per linear foot of display shelving all tended to increase with increased sales volume. Larger stores also had wider aisles and lower height of equipment, factors which facilitate customer shopping.

The impact of affiliated wholesalers was most pronounced in the pricing, advertising, and merchandising policies of member stores. Affiliated stores, following the suggested retail prices and advertising and promotional program of the wholesaler, averaged lower gross margins, lower expense ratios and lower advertising expenditures than the unaffiliated stores. This group of stores employed low prices in the grocery department as their method of attracting trade. Unaffiliated owner operators priced their own merchandise and directed their own advertising and promotional program. Pricing policy of this group of stores differed from the affiliated stores in that produce and meat departments were grossing higher margins and accounting for a larger portion of total sales than the affiliated stores. There was little difference in the average net profit ratio for affiliated and unaffiliated stores, however.

There appeared to be little choice among affiliated wholesalers available to the independent retailer. The major affiliated wholesalers each serviced different portions of the state and tended to gear their programs to the average store in this area. Not all programs were flexible enough to be of assistance to small and large stores alike. The decision confronting a retailer was primarily that of affiliating with the available wholesaler program or depending upon local wholesalers as his source of supply. 205 pages. $2.70. Mic 57-3092

SOURCES OF DEVELOPMENT FUNDS FOR LATIN AMERICA WITH REFERENCE TO THE PROPOSED INTER-AMERICAN BANK FOR ECONOMIC DEVELOPMENT

(Publication No. 22,107)

Elroy Junior Steele, Ph.D.
State University of Iowa, 1957

Chairman: Professor Paul R. Olson

The mobilization and employment of capital resources for economic development in Latin America, and the possibility of expanding such resources by a regional financial institution, is the central subject of this study. The institution under consideration is the proposed Inter-American Bank for Economic Development.

The proposal for the establishment of the Inter-American Bank for Economic Development appears to rest on the following assumptions:

1. The capital "needs" of Latin America are greater than the supply.
2. Domestic capital is limited in Latin American countries.
3. External capital sources and financial institutions are not adequate, or willing, to meet Latin America's "needs."
4. The proposed Bank will significantly aid in the economic development of Latin America.

A consideration of the validity of these assumptions constitutes the basic approach pursued in the study.

An examination of the draft proposal for the establishment of an Inter-American Bank for Economic Development is followed by a historical sketch of foreign capital investment in Latin America. The period from 1820 to World War II reveals the region's dependence upon private foreign capital.

Attention is then directed to post-World War II capital "needs." Several existing estimates for Latin America are examined and compared on the basis of actual performance. It was found that the performance was superior to the estimates.

An examination of the rate of domestic growth in selected Latin American economies, as well as in the region as a whole, is made and compared with the rate of growth in the United States. Contrary to popular belief, Latin America's growth performance is favorable.

An analysis of current external capital flows to Latin America shows that indirect private investment is the dominant form of private lending since World War II. No strong resurgence of private lending to Latin America is indicated. Portfolio investment is concentrated in the lending activities of the Export-Import Bank of Washington and the International Bank for Reconstruction and Development, the major sources of developmental loans to Latin America. This region is the major beneficiary of all lending to underdeveloped areas by these banks.

On the basis of current estimates, capital "needs" of Latin America are being met. The domestic capital resources of Latin America are favorable in terms of the rate of growth. External sources of lending, with the exception of private capital, are improving. The study also points out that the proposed Inter-American Bank for Economic Development would rely on many of the same techniques as those employed by existing lending institutions and would do so with very limited resources. Most of the funds available to the proposed Bank would come from the United States and could be channelled through existing institutions. Greater effort should be devoted to improving existing social and economic institutions which now tend to limit development capacity in Latin America. In this respect, existing regional institutions could be made more effective under the direction of the Inter-American Economic and Social Council.

284 pages. $3.65. Mic 57-3093

ECONOMICS, COMMERCE – BUSINESS

THE COMPETITIVE POSITION OF IMPORTED AUTOMOBILES IN THE AMERICAN MARKET

(Publication No. 22,161)

Leslie Darbyshire, D.B.A.
University of Washington, 1957

This study examines and evaluates the rising volume of imported automobiles registered in this country since the end of World War II. An attempt is made to analyze the competitive positions of the various types of imported cars and to examine the influence of the country of origin, Great Britain and West Germany in particular, upon chances for success or failure.

In the market for economy cars, sales of British makes have been predominantly a function of scarcity of new American cars. The bulk of British sales in this class occurred during the sellers' markets of 1947 - 1948 and 1950 - 1952. The principal German entrant in the small-sedan field, the Volkswagen, has continued to enjoy rising sales since its initial entry into the market and has demonstrated convincingly the existence of a substantial demand for such cars.

In both the sports car and luxury segments of the market it has been left to American models to demonstrate the breadth of potential demand. In terms of registrations, Ford's Thunderbird has been by far the most successful sports-type car, while the same firm's Continental Mark II overwhelmed the sales of its imported rivals within a month or two after its introduction. Britain continues to offer the greatest variety of sports cars and is relatively more successful in this area than with her small sedans. Her most successful sports car, the MG, reintroduced the concept of the sports machine which had been dormant since the failure of companies producing the Cord and the Auburn.

The structures of the German and British automobile industries are remarkably alike with respect to their degrees of concentration and overall capacity. The British industry contains many more small producers, however, and offers a much wider selection of models. Neither of the two industries carries on a very substantial degree of price competition in its domestic market; each has a long history of government protection, trade

association regulation, and closely controlled distribution systems. The greater standardization of the German industry, particularly of the largest producers, Volkswagen, is the main structural difference which gives an advantage to the German firms.

The economic contexts and relationships to their respective governments, within which the British and German industries operate, are as different as their industrial structures are similar. In the early postwar years, the British industry exported the bulk of its output in accordance with governmental export quotas backed up by material allocations. In so doing the insistant demands of the home market could not be met, although the industry naturally chose to sell more widely in the easier markets of the Commonwealth rather than in the more competitive hard currency areas. The principal determinant of Germany's export efforts has been the inability of her domestic market to absorb her total output. The German industry has not been able to rely on protected overseas markets. The British economy, primarily consumption-oriented has been under continual inflationary pressure, making it difficult for her automobile industry to hold prices down. Germany, under continued hard money policies, has not been under the same cost pressures and has been much more successful in maintaining price stability. Neither of the two principal exporting countries' tax levels or structures encourages the development of their automobile industries, although Britain has protected hers by high import duties in addition to the currency restrictions since World War II.

Alone of the importing organizations, Volkswagen has consciously patterned itself after the American manufacturers. By insisting upon single-line franchises, adequate inventories of parts and service facilities, and by making a real attempt to control dealerships, Volkswagen has established a reputation for service matched only by the Big Three.

It is concluded from the study that the chief hope of the British automobile industry is marketing cars in the United States lies in the $2,000 - $3,000 category of the MGA, Triumph TR 3, and the Austin-Healey; in this range no American competition yet exists. The best hope of consolidating and possibly expanding the import share of total United States registrations lies in the expanding market for second cars. American "offshore purchases" in Britain and Germany, and sales to American personnel abroad also offer possibilities for expansion.

To compete with Volkswagen, British car manufacturers must reduce prices and concentrate on fewer models, and dealer and distributor organizations must be modified to bring sales per dealer to a more profitable level and to increase parts inventories and service facilities. Manufacturers must carry more of the burden of importing and stocking parts, and must make additional sales and "floor plan" financing available to dealers. Small sums invested in research on marketing and financing might have produced sizable dividends for British manufacturers. Finally, the trend toward a "supermarket" type of automobile distribution in the United States, to the extent that it develops, will be a substantial benefit to imported car selling in providing a higher level of salesmanship than hitherto.

351 pages. $4.50. Mic 57-466

SOME ASPECTS OF THE EXPERIMENTAL APPROACH IN MARKETING, WITH PARTICULAR REFERENCE TO ITS ROLE IN PRICING

(Publication No. 22.077)

Leo Gilbert Erickson, Ph.D.
State University of Iowa, 1957

Chairman: Associate Professor William A. Knoke

The purposes of this study are to restate a broad range of marketing problems so as to make their solutions more productive and to adapt and develop an experimental method for their solution. Pricing is given special attention, in part as a vehicle for exposition, but primarily because the experimental approach to pricing has been unduly restricted and unproductive.

A brief restatement of theory of price is undertaken in order to provide a background for evaluation of current pricing practices. It is held that sellers likely devote more attention to cost factors in pricing than they do to demand factors. However, sellers do consider demand in pricing, even if such consideration is informal and lacks exactitude. A partial explanation for an apparent emphasis on cost items from realization that price is one of several variables that the seller has at his disposal in marketing his output. Because of interdependency and interaction of these variables it is rather commonly held that it is impossible to assess the effect that a single variable has on sales.

It is maintained in this study that the experimental method of marketing research is theoretically best suited for analysis of the price-quantity relationship for a firm. Such an analysis at the same time should measure the combined and individual effects of price and other competitive factors such as advertising and personal selling. However, the experimental method of marketing research, as currently practiced, does not permit realization of the theoretical advantages of the method. Such is the case because of the common notion that only a single variable should be tested at any one time, and because of a restricted concept of control of experiments.

A suggested approach employing factorial design is developed. Such an approach would permit the gathering of data from which to measure the aggregate and individual effects upon sales and profits from manipulating several variables during a single test. Further, the method of selection of test markets that is advocated would permit precise estimates and enable statement of the degree of confidence held in such estimates.

It is concluded that if the marketer is to gain insight and foresight it would be to his advantage to devote attention to economic theory and to statistical design. Economic theory may provide the generalizations on which to base research hypotheses. Experimental design which will permit multivariable tests are virtually unknown in marketing research. More extensive use of such a device should produce more fruitful research.

263 pages. $3.40. Mic 57-3095

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

SOME IMPLICATIONS REGARDING THE CONCEPT OF INDUSTRIAL ORGANIZATION

(Publication No. 22,081)

Richard Florentz Gonzalez, Ph.D.
State University of Iowa, 1957

Chairman: Professor Karl E. Leib

The literature of the management discipline contains numerous expositions of the administrative activity of organization. The earlier analyses are found in the writings of Henri Fayol, Frederick W. Taylor, Oliver Sheldon, and others. More recent explanations are credited to such authors as Alvin Brown, Chester I. Barnard, Ralph C. Davis, etc. A preliminary survey of the literature indicates a lack of agreement among organizational theorists. At the same time, the student of organization encounters criticisms of the management interpretations.

Objectives. The objectives of this thesis are therefore:

1. The identification of the management concept of organization.
2. An evaluation of that concept to ascertain its limitations and reasonableness.

Methodology. The method for identification is an examination of major formulations regarding organization so that a summary model may be offered. Variables, definitions, principles, and assumptions are compared.

Evaluation of the model is restricted to statements of implications inferred from the nature of the model, the implicit assumptions contained, and the relation the model appears to bear to reality.

The Management Model. Industrial organization is defined as a management process. Results of the process establish interpersonal relationships which facilitate the economic contributions required for production objectives. The basis of organization is division of labor. Specialization of contributions are specified in kind (functions) and according to their direct or indirect relation to production. The two processes (functionalization and delegation) fix the organizational location of specialized contributions.

Specialization continues as long as further economies are possible. The organizational variable is the economically valuable contribution of the participant in the firm. The organizational criterion is economy.

The model depicts the growth-determined characteristics of the organization structure. Structures are catalogued according to the extent and nature of specialization (line, line and staff, etc.).

Implications. Review of the various explanations suggests that the model is bounded by a number of parameters.

1. Contributions are regarded to be made impersonally.
2. Organizational behavior is assumed, i.e., cooperation, submergence of individuality, responsibility, etc.
3. Non-economic activities are excluded from the model.
4. A legal, political, and social framework is assumed --institutionally.

Conclusions. Despite conflicting definitions, the major writings are seen to be in agreement. The resulting model is evaluated to be a partial, static, and unrealistic explanation of industrial organization. However, given the definitions and criterion contained in the model, it affords a minimum explanation of what must be established to facilitate production. The model also provides a bench mark on which inter-disciplinary constructs of organization can be focused. 217 pages. $2.85. Mic 57-3096

EFFECTS OF ACCELERATED DEPRECIATION ON BUSINESS DECISIONS

(Publication No. 22,170)

Dale Severy Harwood, Jr., D.B.A.
University of Washington, 1957

In the years immediately following World War II, considerable pressure was brought to bear for a change in an antiquated tax depreciation policy. A degree of liberalization was finally provided by the Internal Revenue Code of 1954. This allowed for the first time the general tax use of the declining-balance, sum-of-the-years'-digits, and similar methods in the determination of taxable income. Briefly, such "accelerated depreciation" permitted the tax-free recovery of two-thirds an asset's cost in one-half its life.

Those who framed the 1954 code characterized it as a comprehensive revision undertaken to remove inequities, end taxpayer harassment, and lower tax barriers to economic growth. Within this framework, to paraphrase its proponents, accelerated depreciation was designed to assist modernization and to promote industrial expansion which in turn would foster increased production and a higher standard of living.

While the skeptic might view that as a rationalization of a tax favor to the business sector, it was clear that many considered the new depreciation methods a promising means of stimulating investment. This proposition was examined at some length in the dissertation. In brief, it was concluded that while the stimulus of prospective tax savings does exist, it is so small as to be dwarfed into insignificance by other parameters typical of business investment planning.

Next considered was the tax-wisdom of switching to the more rapid methods in the light of the frequently expressed opinion that they provide but a potentially painful deferral of taxes, not a reduction. Such a misconception naturally arises when one focuses his attention on a single asset rather than upon a firm's total depreciable base. As one of the ways of examining this issue, the retrospective effects of straight-line and accelerated depreciation were calculated year by year for the period 1929-1948. Here the conclusion was that the average firm can look upon accelerated depreciation as offering a permanent reduction of taxes even if future business conditions are no more favorable to investment than those of 1929-1948.

Also examined was the available evidence of the extent to which the new methods have been adopted for tax purposes. Briefly, it appeared that approximately 50 per cent of the business taxpayers had switched to an accelerated method as of June, 1955. Very few of these firms chose to record an associated deferral of taxes.

It also appeared that approximately half of these taxpayers, or roughly 26 per cent of all businesses, had likewise adopted accelerated depreciation for general accounting purposes. This adoption, predictable, has been sanctioned by the American Institute of Accountants.

In these firms, accelerated depreciation will have an effect on the multitude of decisions influenced by book values, working capital, costs, profits, and the balance sheet in general. It appears, however, that the accounting use of the new methods will conform to tax restrictions on "eligibility," limiting application to assets acquired subsequent to 1953. The significance of booking the larger amounts will thus increase gradually, perhaps imperceptibly, with the growth in the eligible base.

Accountants concerned with the profession's tendency to follow rather than lead in the development of depreciation practices may find the general use of the new methods a bit disturbing. Those concerned with the combined effects of Lifo and accelerated depreciation on balance sheet values may press for a re-examination of the purpose of the balance sheet. 251 pages. $3.25. Mic 57-3097

THE GUARANTEED ANNUAL WAGE AND ACCOUNTING FOR DECISION MAKING

(Publication No. 22,460)

Robert K. Jaedicke, Ph.D.
University of Minnesota, 1957

In recent years, much attention in the United States has been centered on plans to cope with unstable incomes through the device of "guaranteed wages." This thesis is limited to a discussion of the guaranteed annual wage and approximations to it included among the supplemental unemployment benefit plans. The types of annual plans discussed are those which have been established by various businesses. The discussion includes the conventional type plans (such as exist in the Procter & Gamble Company) as well as the new supplemental unemployment benefit plans (such as those established in the automobile industry).

The existence of a guaranteed annual wage plan introduces a ridigity or fixity into the labor cost. With this change in the nature of the labor cost—that is, the terms under which labor is employed—management should make certain changes in the decision-making process. The accountant can make an important contribution in helping to facilitate this change through proper reporting of the costs involved with the guaranteed annual wage. However, in order to be able to report properly the resulting costs, the accounting and economic implications of the various guaranteed annual wage plans must be thoroughly investigated and properly understood. Such an investigation is the purpose of this thesis.

The thesis can be divided into three main parts. The first part includes a detailed discussion of the various guaranteed annual wage plans, which are examined throughout the thesis, and a general analysis of the costs resulting from the various plans.

The second part of the thesis is devoted to a discussion of the implications of the various plans for financial reporting, inventory costing, and income determination. The emphasis here is on the role of the cost accountant in furnishing reports and information regarding inventory costs which are to be used in determining periodic income. Also included here is a discussion of any balance sheet or other reporting problems created by the various guaranteed annual wage plans.

The third and most important part of the thesis is concerned with the implications of the guaranteed annual wage plans for the decision-making process. The question here is: how should the guaranteed annual wage costs be accounted for if the resulting information is to be used in problems of alternative choice rather than in reporting income? The problems of alternative choice are grouped into three main categories. The categories are: (1) capital budgeting decisions, (2) output decisions, and (3) price policy decisions. The first category includes a discussion of equipment replacement and expansion decisions; the second, a discussion of factor and product combinations as well as the problem of choosing the best level of output; and the third, a discussion of the price policy problems which are created by the change in the nature of the labor cost caused by the various guaranteed annual wage plans. 160 pages. $2.10. Mic 57-3098

ECONOMICS, FINANCE

FINANCIAL EXPANSION OF MEDIUM-SIZE GROWTH CORPORATIONS IN MANUFACTURING

(Publication No. 22,317)

Herbert Melvin Axford, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Frank M. Graner

The purpose of this study is to continue the investigation started by Professor Graner in his Sources of Corporate Funds and Their Uses. This study deals with a sample of medium-size growth companies in manufacturing classified according to the twenty-one main groups or industries in the Standard Industrial Classification Manual. It covers the period 1920 to 1949.

All companies with assets of $3.0 million to $6.9 million as of December 31, 1924 in the 1925 Moody's Manual of Investments, Industrial Securities were identified. From the 502 medium-size companies thus identified those that increased in total assets by $4 million or more to the latest balance sheet in the 1948 Moody's and which could be identified under the same or similar corporate name in 1948, after discarding companies in industry groups with less than four companies,were defined as medium-size growth companies, and these 48 companies constitute the sample in this study. Only 14 per cent of the 502 medium-size companies are medium-size growth companies.

The industries, along with the number of companies in each are: automobiles and equipment (5), chemicals (6), electrical machinery (7), food (4), iron and steel (9), Machinery except electrical (7), nonferrous metals (4), paper (6).

Composite balance sheets were prepared for each industrial group and for the total sample for each year of

the study. Annual changes in these composite figures provided sources and uses of funds Group relatives were found by dividing the industry figures by the total sample figures.

Particular emphasis in this study is on three sources of funds - retained earnings (surplus), depreciation reserves, and ourside financing -- and two uses of funds -- net working capital and changes in net property. Other accounts analyzed are: total assets, capital stock, current liabilities, long-term debt, current assets, inventory, cash, and receivables net.

The principal findings resulted as follows. Medium-size growth corporations did not grow as fast as the average large corporation because: their industrial environment is limited, they are affected by the business cycle and war, and they have difficulties of management succession. They use less reserves but more outside financing than large companies.

The medium-size growth corporations in this study are identified in terms of their nature, means, history, location, methods of expansion, and reasons for expansion. They are found in growth industries. They are not growing to large size, but typically always will be medium-size and are growing only within the limits of their own industrial environment. They are not miniatures of large companies. They are specialized, dependent on research and location. They grew most in the twenties and least during the war.

Significant industrial differences are noted in their financial expansion in balance sheet accounts, group relatives and sources and uses of funds. Groups with the greatest relative growth were autos, chemicals, nonferrous metals, and paper. In relative terms, some groups declined while others grew consistently over a number of years. They relied increasingly on retained earnings and made considerable use of current liabilities from time to time. 327 pages. $4.20. Mic 57-3099

VALUATION OF INVENTORIES FOR INCOME TAX PURPOSES

(Publication No. 22,157)

J. Frederick Barron, Ph.D.
University of Washington, 1957

The valuation of inventories is important for income tax purposes because the income tax is levied upon stated profits. When prices are changing different inventory valuation methods will produce different stated profits and, thus, different tax liabilities. This result obtains because the inventory value is one of the factors entering into the computation of the cost of goods sold. Different inventory values will produce different costs, different profits, and different tax liabilities computed on these profits.

The use of Lifo as a method of valuing the inventory during periods of rising prices will result in a lower stated profit (and tax) than would be the case if Fifo were used. The opposite is true during periods of declining prices.

Early income tax law contained no reference to inventory valuation methods other than to stipulate that the method used for income tax purposes must meet with the approval of the Treasury. Until 1938 the Treasury consistently refused to allow Lifo to be used in the computation of taxable income. Taxpayer efforts resulted in the legalization of Lifo for income tax purposes in the Revenue Acts of 1938 and 1939. Treasury efforts thereafter were directed at restricting its use for income tax purposes to a narrow category of industries. Subsequent to the legalization of Lifo for income tax purposes taxpayers' efforts were directed at broadening the category of industries to which it could be applied for income tax purposes. These efforts resulted in a 1947 decision by the Tax Court in which it was ruled that Lifo might be used by a wide variety of taxpayers in the computation of taxable income.

The only factor in the modern economy which appears to be unfavorable to the use of Lifo for income tax purposes, from the standpoint of the firm, is the requirement that, once elected, its use must be continued by the taxpayer until permission to depart therefrom is granted by the Treasury. The existency of other factors in the economy, however, appears more than to offset this requirement.

Subsequent to achieving the right to use Lifo for income tax purposes, as granted by the Revenue Acts of 1938 and 1939, and after the decision by the Tax Court broadening the applicability of Lifo, taxpayers' efforts have been directed at obtaining the privilege of using the principle of the lower of cost or market for income tax purposes in conjunction with Lifo. The majority of the arguments presently advanced by the advocates of this valuation principle appear not to warrant the legalization of this method to be used in conjunction with Lifo in the computation of taxable income.

The use of Lifo as a method of computing taxable income appears to introduce, on balance, an element of instability into the economy. The use of this method for income tax purposes serves to insulate its users from the effects of automatic stabilizing devices and from the effects of discretionary tax rate changes designed to counteract cyclical activity.

The efficacy of Lifo as a method of improving the manner in which taxes are distributed among taxpayers in general appears to be doubtful. There appears, on balance, to be no sound reason to advocate devices which will tend to stimulate its adoption for income tax purposes, insofar as its effect upon the economy is concerned.

The increased popularity of Lifo and the approval with which it presently is regarded by businessmen appears to be primarily a tax phenomenon. It is doubtful that Lifo would be used by more than a handful of industries in the absence of a combination of rising prices and rising tax rates. 231 pages. $3.00. Mic 57-3100

THE FISCAL SYSTEM AND ECONOMIC DEVELOPMENT IN SYRIA

(Publication No. 21,959)

Bourhan Taher Chatti, Ph.D.
The American University, 1957

Purpose:

The purpose of the present study is to analyze the fiscal system in Syria in relation to the process of economic development and to determine whether or not it is

compatible with the requirements of economic development.

Methodology:

The quantitative method of analysis is followed in the present study except when the relevant data were not obtainable. In this case, the descriptive method is resorted to. Moreover, a comparative analysis is undertaken of the fiscal systems in Syria and a number of other Arab states in the Middle East.

Findings:

National income in Syria is derived mainly from agriculture and the processing of agricultural products. The predominance of agriculture in the Syrian economy is also reflected in the Syrian balance of payments: cotton, cereals and tobacco account for the bulk of exports.

The Syrian economy, which is characterized by the predominance of private enterprise, is not well served by the fiscal system. This system, inherited as it was from the Ottoman Empire, was kept almost intact during the French Mandate from 1921 to 1941. The major structural changes took place since independence. Despite continuous efforts since 1945 to reform the fiscal system, it continues to be plagued by ancient Ottoman institutions and complicated French procedures.

Despite a tremendous increase in the receipts and expenditures of the Government since 1931, and in spite of borrowing relatively large amounts from the Bank of Issue since 1948, Government spending activity is still far from meeting the basic needs of an expanding domestic economy. Although the fiscal system in Syria does not bear heavily on business because of the high degree of shiftability of some taxes and because of generous fiscal privileges, the system is not designed to foster any policy of economic development.

Thus, the fiscal problem as it faces the Syrian Government is twofold: to modify the fiscal system in a way to conform to a policy of economic development, and to increase its yield in order for the Government to increase its share in the process of capital formation. Consequently, the fiscal problem boils down to an analysis of the adaptability of the fiscal system to the requirements of economic development. The analysis centers around the three important elements of any fiscal system: its capacity, efficiency, and flexibility, which together, when they are of suitable proportion to each other, determine the good functioning of the fiscal system.

367 pages. $4.70. Mic 57-3101

THE DETERMINATION OF THE STOCK OF MONEY AND THE PROMOTION OF ECONOMIC ACTIVITIES IN EGYPT

(Publication No. 22,348)

Sobhi Tadros Geraissa, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Martin Bronfenbrenner

This study has two objectives. (A) Investigation of the factors determining the stock of money in Egypt under two monetary systems; the Sterling Exchange System which operated from 1916 to 1947 and the new monetary arrangements enacted in 1948-1951, and (B) Investigation of Egypt's twin problems; economic poverty and economic instability in terms of the bearing of the operation of the Sterling Exchange System and the extent to which the new monetary system might contribute to their solution.

I. Under the operation of the Sterling Exchange System, the role of the National Bank of Egypt in controlling legal tender and commercial credit was passive.

In wartime, expenditures of foreign troops were the predominant factor causing increases in the stock of money. The general rises in price levels which were caused by the increases in the stock of money were tempered by the decline in its velocity of circulation. Military spending and money creation took the course of a money-price-money spiral.

In the inter-war period, the demand for money was mainly conditioned by: (a) changes in the trade balance, (b) changes in cotton values which were the major determinants of the bank's advances and, (c) a galaxy of other factors influencing the bank's investments.

II. The new monetary arrangements of 1948-1951 virtually delegated the monetary control to the state. They equipped the National Bank of Egypt with weapons to control commercial credit. However; the most effective practical weapon of the new central bank is the variation of the compulsory reserve ratios.

The new system has tended to free the money supply from the trade balance and to insulate the Egyptian capital and money markets from markets elsewhere.

III. Combined with adverse social conditions, low real per capita income and low productivity of the Egyptian economy stem fundamentally from adverse ratio between population and economic resources.

Fluctuations of export values may be held as the major source causing fluctuations in money national income. Changes in the terms of trade have had significant effects on real national income.

IV. The operation of the Sterling Exchange System sacrificed domestic monetary equilibrium for international equilibrium. Stable monetary relationships between Egypt and the Sterling group may be credited with reducing instability in the markets for Egypt's export; but the domestic purchasing power of the Egyptian pound fell drastically in wartime. Monetary policies of desirable social effects conflicted with the maintenance of the parity between the Egyptian pound and Sterling.

The Credit System fitted itself to a "lopsided development" of the Egyptian economy. Commercial banks concentrated their operations on financing foreign trade and looked for foreign markets to invest their funds. They contributed little to mobilizing personal savings and financing domestic capital formation. Bank Misr attempted to fill this gap but met with economic risks associated with such practices.

V. The conflict between external and internal stability in the Egyptian economy requires some resort to domestic monetary measures to offset external disturbances of limited scope.

Low elasticity of domestic production, low real per capita income and high propensity to import would render an over-all policy of inflationary financing of capital formation in Egypt a tricky path.

In general, the central bank of Egypt should strive to see that economic development is made within a framework of a "reasonable" financial stability. That is to

say, aggregate spending should be kept generally within the limits of the available resources at current prices.
185 pages. $2.45. Mic 57-3102

AGRICULTURAL TAXATION IN IRAQ

(Publication No. 22,356)

Sadun Lawlah Hammadi, Ph.D.
The University of Wisconsin, 1957

Supervisors: Professors Kenneth H. Parsons and Harold M. Groves

The focus of this study is to evaluate the alternative methods of taxing agriculture in Iraq with a special emphasis on the possibility of instituting a fixed land tax. At the present time agriculture is only subject to a kind of a produce tax of ten per cent of the gross value of the commodities sold in the market, called the Istihlak.

This tax is defective in many aspects. Its burden is regressive as between the landlords and the tenants, it is passed, partially at least, to the consumers, its administration proved to very difficult, and it falls only on cultivated land. Idle land is not taxed.

The other alternatives to tax agriculture are to extend the regular income tax to cover agricultural income, or to extend the existing urban property tax to cover agricultural property. The former is difficult to apply to Iraq because agriculture is not highly commercialized, and illiteracy is widespread among the farm people. The latter is also inadequate because the existing urban property tax is only on buildings; land sites are exempted, while the major part of rural property consists of land. Also including personal property creates a difficulty of assessment.

The scheme proposed in this study centers around establishing a fixed land tax based on the productive capacity of the land regardless of whether it is actually cultivated or not. The rental value can not be used as the basis of assessment because the land is rented on a share crop rather than a fixed cash or crop basis. The market value can not be used due to the lack of an organized land market. A nationwide survey of agricultural conditions is necessary to construct a land classification. The classification is to be conducted as a technical project by the central government with the cooperation of local governments. The assessment of each property is to be carried by local committees composed of government officials and local cultivators under the direction of a land tax department to be established in the Ministry of Finance. The taxpayer is given the right to protect the assessment of his land first to an appeal committee and finally to the Land Tax Department. For the time being the rate is to be ten per cent of the net output of the land assessed in kind and collected in money by multiplying it by the average current price. Each assessment is to be constant for a period of five years during which partial assessment can be carried if a significant change in the agricultural conditions takes place. A per capita minimum exemption is to be granted to small farmers. The tax is to be paid exclusively by the land holders. It should be clearly distinguished from the rent charges for using the state's land and providing water. The proceeds of the tax are to be turned partially at least to the local governments (liwas) to be used, in cooperation with the Development Board, in financing local, light agricultural schemes.

The proposed tax has economic and social advantages. It puts a cost on holding land idle and establishes the principle of subjecting the big landholders to the tax authority. It helps to curb the political and economic power of the landlords. The tax change and the expenditure of the revenue have an expansionary effect by increasing output and employment. Its administrative superiority stems from the fact that it is assessed on the basis of an objective criterion namely the productivity of the soil.

It favourably affects the distribution of income in that it helps to bring more equality between the low and the high income groups. The primary difficulty facing the scheme stems from the unfavourable political conditions in general and the inefficiency of the administration in particular. 320 pages. $4.10. Mic 57-3103

INTERGOVERNMENTAL FISCAL RELATIONS AND THE CITY OF NEW YORK

(Publication No. 22,061)

Jackson Robert Edward Phillips, Ph.D.
Columbia University, 1957

The finances of the City of New York are related to those of the Federal government, the independent agencies operating within its area, governments of the surrounding area, and particularly to those of the State of New York. The State government controls the maximum rate of the City's property tax, it establishes the bases and rate limits of the City's non-property taxes, and it limits the amount of the City's debt. Moreover, the City depends on the State and Federal governments for grants covering about a fourth of its current annual expenses. Therefore, when the City's financial requirements increase, as they have under inflationary pressures and demands for more services, the City turns to the State for funds. In recent years these demands have been debated in an atmosphere of petty bickering; no long-term solution has been sought.

The City historically relied on the general property tax, later redefined on a realty basis only. The depression brought about the City's non-property taxes. Grants and shared taxes were developed by the State to assist local governments at the same time it developed its own tax system by utilizing parts of the general property tax base. The aid system, however, seeks to accomplish more than supplying localities with revenue. Through grants the State seeks to equalize resources for the financing of certain functions and it seeks to stimulate performance of other functions. As a whole the State-local fiscal system seeks to provide a degree of stability against counter cyclical fluctuations.

How can the City permanently be given additional revenue sources without disturbing the present objectives of the State-local fiscal system? It is recognized that City residents on net balance contribute to financing grants for the rest of the State; therefore, additional grants might cost more than the aid received. Increasing the City's permissive taxes might dilute the present State revenue system and impose an inequitable burden on City residents.

It is proposed that New York City be made a fiscally independent unit within New York State. To accomplish this and the other stated objectives the City would exchange its right to present State grants and would receive sole right to levy the taxes within its area the State now imposes. In addition, the City would pay its fair contribution to State equalization purposes and would pay the State for services it now performs for City residents. From the service payment would be subtracted annually an amount to account for the City's cost of services it provides for out-of-City residents who earn their income in the City. If the State did not recognize this item, it is proposed that the City purchase this right from the State. Such a purchase price plus the other payments that would be made would equal the amount of new taxing power the City receives, so that the City and State would be in the same relative financial position as at present. The City service charge item and adjustments in the equalization payment would provide for future shifts in wealth as between governmental units. 357 pages. $4.60. Mic 57-3104

ECONOMICS, HISTORY

SUEZ AND BRITAIN: AN HISTORICAL STUDY OF THE EFFECTS OF THE SUEZ CANAL ON THE BRITISH ECONOMY

(Publication No. 22,345)

Max Ellis Fletcher, Ph.D.
The University of Wisconsin, 1957

Supervisor: Assistant Professor Rondo E. Cameron

Much has been written concerning the Suez Canal as a great work of engineering; much, too, on its political and strategic importance; but no successful attempt has been made to provide a thoroughgoing, systematic account of the part played by the canal in the great economic changes of the past century. This study is designed to fill this gap in part by tracing with some degree of precision the role played by Suez in the major changes that have taken place since 1869 in the economy of the country most profoundly influenced by the opening of the canal: Great Britain.

Britain reached the peak of her economic ascendancy in the early 1870's. At that time "she was the biggest manufacturer, the biggest exporter, the biggest investor, and the biggest carrier the world had ever known." By 1914, however, Britain was no longer the world's dominant economic power. Both the United States and Germany surpassed her in several of the basic industries and other countries had narrowed her lead. The part played by Suez in accelerating or restraining Britain's relative economic decline is the major problem this study attempts to resolve.

For almost a quarter of a century the various British governments opposed, by all means at their disposal short of war, the cutting of a channel between the Mediterranean and the Red Sea. But when the canal was opened in 1869, British ships easily led those of all other flags making use of the waterway. From the opening of the canal to the end of the nineteenth century British tonnage comprised from two-thirds to three-fourths of the annual canal tonnage. In 1875 Disraeli purchased the Egyptian Khedive's canal shares in an attempt to guarantee the security of British passage through the canal.

The major impact of the opening of Suez in the British shipping and shipbuilding industry was an acceleration of the shift from sailing ships to iron, screw-propelled steamships equipped with compound engines. Almost without exception the canal was an all-steamer route. By throwing open the whole of the vast, lucrative trading area east of Suez to steamships, the canal gave a great impetus to the building of large, fast, economical steamers, thereby directly turning the steamship into a general cargo carrier in the Eastern trade, indirectly in all other trades. Great Britain's relative advantages in the construction and operation of steamships were much greater than in sailing ships, so in this regard the Suez Canal was a boom to the British economy.

The British trade with India also benefited from the opening of the canal. The decline in freight rates brought about by the opening of Suez led to the development of an important multilateral trade pattern which facilitated the expansion of British exports to India.

The opening of Suez adversely affected the British entrepot trade in Eastern goods, but not to the extent indicated by previous analysts. The loss of former customers by the London and Liverpool entrepot markets was partially offset by the establishment of new connections with the help of the new route.

The Suez Canal contributed heavily to the transition during the present century from the "Age of Coal" to the "Age of Oil," and that transition has in turn profoundly affected the relationship of Britain to the canal.

352 pages. $4.50. Mic 57-3105

THE DEVELOPMENT OF THE LABOR MOVEMENT IN MILWAUKEE

(Publication No. 22,346)

Thomas William Gavett, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Selig Perlman

The purpose of the dissertation is to relate the history of the Milwaukee labor movement from its inception to recent times, the environmental factors that have influenced its development, and the inferences that may be drawn from the history.

The history has been treated chronologically, although material has been placed in topics within the chronological framework. Although all secondary sources available have been consulted, there has been little written on the Milwaukee labor movement itself. Major emphasis has been placed upon primary sources, particularly the minutes and correspondence of the city centrals.

The dissertation is divided into three parts. Part One deals with developments from approximately 1847 to 1886. Prior to the Civil War, the trade unions in Milwaukee were feeble, transient organizations. During the 1860's the movement reflected developments on the national scene, such as an interest in the programs of the National

Labor Union. With the depression of the 1870's, the Milwaukee labor movement virtually disappeared, and a non-assimilated socialism came to the fore. Economic revival proved the undoing of socialism, and trade unions multiplied rapidly, pausing but temporarily for the brief recession of 1884 to 1885. In 1885 the Knights of Labor in Milwaukee began a record of amazing growth. The course of events was changed, however, by the riot of 1886, second only to the Haymarket Affair in Chicago in its impact on the labor movement. After the riot, the Knights of Labor became committed to a program of political action which ultimately brought its end. Part Two covers the period from 1887 to 1932. Beginning with the formation of the Federated Trades Council of Milwaukee, the trade unions officially remained aloof from the politics sponsored by the Knights, although many individual members were active in the People's Party of the time. Most significant was the growing alliance between the pragmatic socialism represented by Victor Berger and the trade unions, climaxed in December, 1899 by the election of a majority of Socialists to the executive board of the Trades Council. The Alliance brought political victory in 1910 when the Socialists elected a mayor, and contributed to the notable record of labor legislation in Wisconsin. However, vigorous counter-activities by the employers, strains between the Socialists and the unions in the First World War, and the trade unions decline of the 1920's undermined the alliance and brought it near an end. Part Three, dealing with developments since 1932, begins with the turbulent era of the New Deal - a period of rapid union growth, favorable and unfavorable labor legislation, a split in the labor movement, and the abandonment of the Socialist Party as a vehicle for political expression. The Great Depression opened avenues for the Communist Party, which gained an unusual degree of influence in the CIO unions of the city. The CIO city central, dominated by Communists until 1946, and the union at Allis-Chalmers, Communist controlled until 1947, were the focal points of the ten-year struggle. The postwar reaction against unionism brought a unification of labor politically, through more orthodox channels, and organically.

The most unique aspect of the Milwaukee labor movement was its alliance with the conservative branch of the Socialist Party. Political victory and an early interest in protective labor legislation were the most obvious fruits of the alliance, but it also brought an ideology less important for the expressed ultimate objectives of socialism than for the raison d'être it evoked in the participants which gave their interest in the labor movement an almost religious character. 459 pages. $5.85. Mic 57-3106

THE ECONOMIC DEVELOPMENT OF THE OUTER MONGOLIAN ECONOMY IN RECENT TIMES

(Publication No. 22,179)

George Gregory S. Murphy, Ph.D.
University of Washington, 1957

The dissertation attempts the following:
1) To expand the knowledge of the economy of Outer Mongolia.
2) To provide a conceptual framework for dealing with pastoral nomadism.
3) It attempts to prove that the relative stability of the Outer Mongolian pastoral economy from 1691 to 1921 was due to social, political and economic reasons rather than to geographic or social reasons alone as others have argued.
4) The relative stability was the result of, firstly, a lack of internal pressure for change in Mongolia and, secondly, its situation in a Central Asian and (implicity) world political equilibrium. The latter permitted external pressure for change only of a kind leading to minor adaptations in the Mongol nomadic pastoral economy.
5) External pressures and the process of internal change did lead to a substantial change in the non pastoral sector of the Outer Mongolian economy. The growth of a Chinese trade monopoly and of Buddhistic institutions, which had economic importance, led not only to institutional change but may possibly have resulted in economic development in the sense of growth of per capita income.
6) Although small in extent the minor adaptations in the Mongol nomadic economy warrant attention as they show that the nomad may be more responsive to economic forces than commonly thought. They also warrant attention since they tend to contravert the commonly held view that trade with sedentary folk leads the nomad to an extreme specialization in stockbreeding.
7) Given an alteration in the basic social, economic and political conditions it is possible for the economy of the region to develop. Lack of data and lack of adequate theories prevent estimation of the extent to which development is possible. There are, however, no a priori reasons for believing that the region is undevelopable.
8) Satelliteship under the Soviet Union has created social conditions favoring development, albeit at considerable social cost. Until World War II, however, there was little development due largely to overriding political considerations. Generally speaking Soviet literature on the country is misleading for it attempts to give the impression of greater economic development than has taken place.
9) Although it has created conditions for change, satelliteship has also led to a mechanical transference to Mongolia of Soviet institutions and of the Soviet method of ensuring economic growth. These have not transplanted too well to this sparsely populated region. Hence the rate of Mongolian economic development has been slower than might have been possible under different conditions.
10) Postwar external political conditions as well as domestic social change seem to present the possibility for more rapid economic development than hitherto.

401 pages. $5.15. Mic 57-3107

ECONOMICS, THEORY

THE CRITERIA OF A SUCCESSFUL FLEXIBLE EXCHANGE SYSTEM

(Publication No. 22,380)

Chi-Ling Lee, Ph.D.
The University of Wisconsin, 1957

Supervisor: P. T. Ellsworth

This study is intended to investigate the key factors involved in the successful operation of a flexible exchange system.

Chapter I compares the adjustable peg and the freely fluctuating exchange system and examines the relevant issues. The alleged superiority of a flexible exchange system is refuted, on the ground that economic conditions in many countries may not meet the criteria required for its successful operation.

Chapter II shows that an equilibrium rate of exchange cannot always be determined in advance.

Chapter III to V discuss the requirements for a stable exchange market and internal balance. Price effects are analyzed in chapter III. Some simple algebraic equations and diagrams, instead of the conventional verbal expression, are used to show the elasticities required to improve the trade balance after depreciation.

Income effects are considered in chapter IV, which reviews the real-income-absorption approach and the controversy between Haberler and Polak concerning the multiplicand with a foreign trade multiplier. It is found that, since exports are, and imports are not, an income generating factor, the increment of exports, instead of the net difference of the trade balance should be used as the multiplicand. The case of an equal and simultaneous expansion of imports and exports, with a multiplier of one, is also discussed.

Monetary aspects are discussed in chapter V.

Chapter VI contains a brief survey of the Canadian case. It is found that, owing to the strength of the economy, speculative capital movements have been equilibrating during the period from 1951 to 1956. The flexible exchange rate, however, did not prevent the transmission to Canada of the mild U.S. recession of 1954. This occured because of the high income elasticity of U.S. demand for Canadian exports.

In conclusion, the following factors were found to be essential for the successful operation of a flexible exchange system:

1. In the absence of capital movements, the stability of the exchange market is dependent largely on the elasticities of demand for and supply of both exports and imports. For a country whose elasticities do not meet the stability requirement, fluctuation of the exchange rate can hardly serve the purpose of adjusting the trade balance through price effects.

2. The maintenance of both external and internal stability will be much easier if there are potential resources available for the replacement of imports, for expansion of exports, and for new outlets for investment. Without potential resources, fluctuation of the exchange rate is likely to induce domestic inflation.

3. General economic conditions in the country concerned are also important. The effectiveness of depreciation in changing relative prices, and the effectiveness of short-term capital movements in restoring equilibrium, are largely dependent upon public confidence in the strength and prospects of the economy.

127 pages. $2.00. Mic 57-3108

A SYNTHESIS OF THEORIES OF LOCATION, TRANSPORTATION RATES, AND SPATIAL PRICE EQUILIBRIUM, WITH APPLICATIONS TO THE DEVELOPMENT OF THE MEAT-PACKING INDUSTRY IN THE SOUTHEASTERN STATES

(Publication No. 22,092)

Earle W. Orr, Jr., Ph.D.
State University of Iowa, 1957

Chairman: Robert H. Johnson

The analysis in this dissertation is directed toward two related but functionally distinct goals. One of these goals is the establishment of theoretical models of pricing and allocation which integrate the separate analyses of location, transport rates, and geographical price patterns. The second goal is to appraise, by use of an approach suggested by the theory, the future of the meat-packing industry in the Southeastern states. As an integral part of the second phase of the study, an effort is made to determine whether transportation rates and services impede, promote, or are neutral to the further development of meat packing in that region.

The development of economic analysis tends to trace the following pattern. First, there is an intensive investigation of specific problem areas, such as rate determination. Despite the great number and variety of such problems, the analysis of them is amenable to a small number of formal techniques, such as the maximization (or minimization) of some key variable. The next theoretical step is the integration of the analyses concerned with various specific, but related, problem areas. The process of integration may itself cast new light on the specific problem areas that are integrated. While all this is going on, there is, ideally, an interplay between observations of the real economic world and the models adumbrating it in the formulations of the theorist. It is this soft of pattern which this dissertation attempts to follow in miniature.

Much of traditional location theory has not been developed in the context of price theory. (The elaborate and highly idealized work of Losch is an exception.) The prices and the quantities produced of inputs and outputs at different places, along with transport rates, are spatial variables treated as given data in traditional locational analysis. In this dissertation, these variables are treated as endogenously determined within the system which comprises the model. Also, perfect competition and constant returns to scale, typical assumptions in locational analysis, are not assumed throughout this thesis. The assumption of constant returns will not admit of regions which may both produce a part and import a part of the quantities supplied of one or more of the goods they consume. Nevertheless, in meat packing, as well as other industries, importation and local production occur

simultaneously in some regions. The reason for this simultaneous occurrence is found in the regional variations in returns to scale. These variations are at the core of the analysis in this dissertation.

The models employed are variations, with ramifications of the "spatial equilibrium" models developed by such writers as Samuelson, Enke, Baumol, Fox, Beckman, and Mighell and Black. The models are discrete in the sense that they treat finite, predetermined regions or points in space. International trade models, to which the analysis of this thesis is closely related, are also discrete in this sense.

Variations in the locational pattern of economic activity may be thought of as comprising (1) changes in the intensity of utilization of existing capacity at different places and (2) differential rates of growth of capacity between places, whether or not involving direct movements of real capital. Thus location analysis, in this sense, has both short-run and long-run aspects. The models presented below are amenable to both aspects; or, if discontinuous cost functions are introduced, they may be made to bridge the rather arbitrary dichotomy which exists between short-run and long-run analysis. The models are couched, for the most part, in terms of the marginal analysis; but some of them can be developed through applications of linear programming. The discussion is related to a single output and to a limited number of regions in most instances, but can presumably be extended to any number of products and regions. Models are given in which either perfect or imperfect competition in the non-transport industries is assumed. Those in which imperfect competition is assumed include cases which involve the theory or multiple-plant firms, a theory made difficult by the complexity of the second-order conditions for equilibrium.

The following are the "givens" of the models:

(1) regional demand relations (or functions).

(2) regional supply or cost relations (or functions).

(3) transport cost relations (or functions) faced by the carriers.

The variables to be determined are:

(1) the regional pattern of outputs.

(2) the regional pattern of consumption.

(3) the regional pattern of product prices.

(4) the volume of trade between each pair of regions.

(5) the transport rate on movements between regions.

The term "regions" may be interpreted broadly to include (for example) nations, blocks of states, counties, etc., single cities, or central cities and their respective market and/or supply hinterlands. A solution to the above problem determines the locational pattern of production and more.

In the process of solution, a demand function for the transportation of a good between a specific pair of origins and destinations is derived, and this function, together with the transport cost function, determines transport rates, which will not necessarily be rigidly related to distance, contrary to facile assumptions in many locational analyses despite the inconclusiveness of empirical evidence and the lack of theoretical economic justification for such a relationship.

In the derivation of the transport demand function, a means is suggested for resolving the ambiguity of the term "the value of the service," which is employed extensively and obscurely in transport rate theory. It is shown that the demand curve can be interpreted as a "marginal value of the service" function and that the area under the demand curve can be interpreted as a measure of the "total value of the service," which can be partitioned into measures analogous to "consumers' surplus" and "producers' surplus," and which have uses similar to those of these analogues.

Where there is imperfect competition and multiple-plant operation, it is shown that profits are maximized (i.e., an equilibrium exists) where marginal costs equal marginal revenues, such that the levels of marginal cost and marginal revenue at each plant differ by the amount of the freight rate applicable to shipments between them. For each plant, the difference between the quantity produced and the quantity sold at the equilibrium level of marginal cost and marginal revenue is the quantity "exported" or "imported" to or from another plant in the system. If there is no plant in a particular market area, cost curves may be assumed to coincide with the price axis, and the equilibrium conditions remain as above. The decision as to whether or not to add or delete a plant to or from a system of plants rests upon a comparison of the equilibrium profits of the system with and without the plant in question.

Linear programming techniques can also be developed to determine the same kinds of answers from the same information as is treated in the models employing the marginal analysis. An interesting characteristic of the transport demand relation derived by linear programming techniques is that it has a stair-step shape, a characteristic which follows from the formal properties of linear programming techniques, and which is corroborated in many cases by empirical evidence. The usefulness of the spatial equilibrium model, either in its marginal-analytic or its linear-programming form, is far from exhausted.

The future of the meat-packing industry hinges on the following considerations: (1) the growth of demand for meats in the Southeast and other regions, (2) increases in the supply of livestock in the Southeast and other regions, (3) comparative rates on both livestock and livestock products from the Southeast to the Northeast versus rates from the West to the Northeast and to the Southeast, and (4) comparative rates on livestock versus livestock products from the Southeast to the Northeast.

The growth of industry and of incomes in the Southeast implies an increase in the demand for meats in that region. Technological advances in livestock production in the South, coupled with an increased willingness to innovate, implies continued increases in livestock production, but the Southeast will probably remain a deficit area in the production of quality meats.

The major issue concerning whether or not freight rates shall impede the future developments of meat packing seems to center on the comparative meat rates from Southern Territory to Official Territory on the one hand, and rates within Official Territory on the other. In general, these rate relationships appear unfavorable to southern packers who wish to market some of their products in the Northeast. The major barrier to an adjustment of these rates lies in the fact that such an adjustment would, in the current view of the Interstate Commerce Commission, make rates from the South to the Northeast unduly low relative to many rates from the Midwest to the Northeast. Thus, the adjustment of rates from South to North, requiring as it would adjustments of rates from West to East, does not appear to be likely.

458 pages. $5.85. Mic 57-3109

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

THE THEORY AND STATISTICAL APPROXIMATION OF REGIONAL MULTIPLIERS

(Publication No. 20,203)

John Grant Ranlett, Ph.D.
University of Oregon, 1957

Adviser: Paul B. Simpson

The closed system multiplier has been developed primarily as a device for the analysis of business cycles. The theory is based on the premise that savings are closely related to income. It follows that any fluctuation in investment has a multiple effect on income since the latter must vary sufficiently to maintain savings equal to investment.

Regional multipliers take account of the fact that exports are similar to investment in that the savings of a region can find an outlet in the form of claims on the residents of an outside region. On the other hand, imports curtail the outlets for savings. It follows that the theory of regional multipliers is a savings investment theory and also a theory of the income position of a region. Thus regional multipliers are important for the light that they shed on the savings investment relation of the closed system, and for the light which they shed on regional development.

The purpose of this study is to develop the theory of regional multipliers, to consider the problem of empirical evaluation of the multiplier, and to make tentative calculations of such multipliers.

One type of multiplier is the investment multiplier. Assuming linear consumption functions for both locally produced and for imported goods and assuming that the level of investment activity and government to be autonomously determined, the two region multiplier for region one is shown to be $\frac{dY_1}{dI_{11}} = \frac{1-\alpha_2}{(1-\alpha_1)(1-\alpha_2)-\beta_1\beta_2}$ where α_1, α_2, β_1, and β_2 are respectively the marginal propensities to consume locally produced goods for regions one and two and the marginal propensity to import of regions one and two. The marginal propensities to consume locally produced goods and the marginal propensities to import are assumed to be positive but less than one. This multiplier is clearly related to a closed system multiplier, and its regional significance is determined by the amount of savings in each region made possible by the change in investment in region one.

A variation on this multiplier is obtained by considering debt financed government transfers. This multiplier is given by $\frac{dY_1}{dTr} = \frac{\alpha_1(1-\alpha_2) + \beta_1\beta_2}{(1-\alpha_1)(1-\alpha_2) - \beta_1\beta_2}$ where the α's and β's are the marginal propensities to consume local goods and to import, respectively. This multiplier is assumed to operate through the consumption functions of the two regions. This multiplier is less than the investment multiplier.

A second basic type of regional multiplier is the demand multiplier. This operates when there occurs a shift of demand for the goods of a region. In this situation two possibilities may be considered. The shift in demand may be a parallel shift, or the shift may be non-parallel. In the first case all that has happened is a change in the average demand; in the second case there has occurred a change in the marginal demand. Both types of multipliers are derived.

The demand multiplier and the investment multiplier can operate simultaneously. This gives a combined multiplier. This is significant where a growing region has increased exports and large investment.

The empirical work is based on data for 1947. It was felt that a detailed study of one year would contribute to the problem of analysing regional change over a sequence of years. The year 1947 was chosen because of the relative abundance of primary statistical data. Principal sources include the 1947 Census of Manfactures, the Statistics of Income, 1947, and the "Interindustry Relations Study for 1947," which makes available the Bureau of Interindustry Economics' input-output matrix for 1947. Many additional sources have been used.

230 pages. $3.00. Mic 57-3110

EDUCATION, GENERAL

THE FLORIDA SEMINOLE: A STUDY IN ACCULTURATION, CULTURE CHANGE AND CURRICULUM

(Publication No. 22,226)

Ira Albert England, Ed.D.
The University of Florida, 1957

The problem was to derive culture data pertaining to the Florida Seminole culture that should be considered by curriculum workers as to acceptance or rejection of curriculum elements by the culture. Through this process it was possible to gain insights into procedures that might produce the least disorganization within the structure of the culture and most effectively promote social-cultural fusion.

Related studies in archaeology, history, and ethnology were systematically analyzed. Field-work was then initiated in the analysis of records in the Seminole Indian Agency and in Broward, Dade, Monroe, and Hendry counties. Interviews were held with Seminole Indian Agency officers and personnel; Seminole people in Dania, Brighton, and Big Cypress reservations; Seminole people on the Tamiami Trai; county officers and personnel in the above named counties; and with friends and acquaintances of the Seminoles.

Culture trait criteria derived from Ruth Benedict's Patterns of Culture were then applied to an analysis and

typing of the Florida Seminole culture as "Apollonian." Curriculum implications also were derived from the culture traits for the consideration of curriculum workers.

Processes of culture change, culture transfer, and acculturation criteria derived from a study of Ralph Linton's Acculturation in Seven American Indian Tribes were then applied to an analysis of Florida Seminole culture. Then implications of these criteria were analyzed for the consideration of curriculum workers.

In brief, the findings of this study were:

Culture change occurred in identifiable culture periods; American culture contact had been long enough and of the type to cause enforced and directed culture change; Seminole culture patterns deterred culture change; beneficent enforced and directed culture change caused enforcement to occur within the Seminole culture; and curriculum was accepted or rejected in the processes of culture change.

Culture transfer occurred in identifiable contact periods; great numbers of culture elements were transferred in the American contact period; Seminole culture patterns tended to deter transfer; population increases and death rate decreases increased the amount of transfer required; and criteria of culture transfer indicated reasons for acceptance or rejection of curricula.

Acculturation was limited by the length of contact; the American contact period was of sufficient length to facilitate acculturation; culture patterns deterred acculturation; controlled and beneficent processes of acculturation produced enforcement of acculturation in the Seminole culture; and acceptance or rejection of curricula occurred in the processes of acculturation.

Recommendations, based on these findings are:

That curriculum workers consider culture contact periods limit the amount of culture change; processes of enforced and directed culture change may result in culture disorganization; culture patterns may deter culture change; control and beneficial aspects of the processes of enforced and directed culture change and processes of culture change determine the acceptance or rejection of the curriculum.

That curriculum workers consider culture contact contributed to the present form of Seminole culture; the American period is of sufficient length and nature for large numbers of culture elements to be transferred; culture patterns deter culture transfer; control of culture enforcement and direction can increase culture transfer; and acceptance or rejection of curricula influence the amount of culture transfer in later transfers.

That curriculum workers consider culture contact periods result in different forms of acculturation; the processes of acculturation determine the degree of acculturation; culture patterns may deter or facilitate acculturation; enforced and directed processes of acculturation may be controlled that they may continue in a beneficent manner; and the processes of acculturation may result in the acceptance or rejection of acculturation.

225 pages. $2.95. Mic 57-3111

A STUDY OF THE RELATIONSHIP BETWEEN TELEVIEWING AND READING ABILITIES OF EIGHTH GRADE STUDENTS

(Publication No. 22,457)

Paul John Heideman, Ph.D.
University of Minnesota, 1957

The Problem

The problem of this investigation was to determine whether there is a relationship between amount of televiewing, reading abilities, and knowledge of current world affairs of eighth students.

The Procedure

The study was made on a random sample of one hundred boys and ninety-nine girls drawn from the eighth grade pupil-population enrolled in the five junior high schools of St. Paul, Minnesota.

The amount of televiewing was measured by means of a check-list inventory of programs administered over a 12-day period. The reading abilities were measured with the Gates Reading Survey For Grades Three To Ten. The intelligence of each student was measured with the New Stanford-Binet Tests of Intelligence. The Barr Rating Scale was applied to the reported occupations of fathers to determine the socio-economic status of the pupils' families. Scores on knowledge of current affairs were secured by means of the Test on Current World Affairs, published by the Minneapolis Star.

Televiewing groups from each sex were selected from the extremes of the televiewing distribution and tested for differences on the reading variables.

A high-achieving and a non-achieving group in knowledge of current affairs was selected from each sex group of the sample and tested for differences on televiewing, general reading ability, and power of reading comprehension.

Results

1. When intelligence was controlled, the difference between the means of the high and the low televiewers among the boys was significant on general reading ability; on vocabulary and on comprehension, the difference reached the doubtful level of significance; on speed of reading, the difference was non-significant. All of the differences were in favor of the high televiewing group.

The same pattern of differences prevailed on the readings variables of the high and the low televiewers among the boys when economic status was held constant, and also when intelligence and economic status were simultaneously controlled.

Among the girls, the difference between the means of the high and the low televiewers on vocabulary reached the doubtful level of significance when intelligence and economic status were simultaneously controlled. This difference was in favor of the low televiewers.

2. The difference between the means of the high-achieving and the non-achieving groups in current affairs among the girls reached the doubtful level of significance on televiewing when neither intelligence nor economic status was controlled; it passed the .01 level when intelligence was controlled, and it was reduced to the level of non-significance when economic status was controlled. The difference was in favor of the non-achieving group.

In both sexes, the difference between the means of the high-achieving and the non-achieving groups in knowledge

of current affairs was significant on general reading ability and on reading comprehension. This difference remained between the means of the boys' groups when intelligence or economic status was controlled. The difference disappeared between the means of the girls' groups on general reading ability when intelligence or economic status was controlled. It also disappeared on comprehension between the means of the girls' groups when intelligence was controlled and it was reduced to a doubtful level when economic status was controlled. All of the differences were in favor of the high-achieving groups in both sexes.

Conclusion

The conclusion is that there is a positive relationship between televiewing and reading abilities among boys and between knowledge of current affairs and reading abilities among boys. There is also a positive relationship between knowledge of current affairs and reading abilities among girls but this can be accounted for by differences in intelligence or economic status. 213 pages. $2.80. Mic 57-3112

AUDIO-VISUAL PROGRAMS IN CALIFORNIA PUBLIC SCHOOL DISTRICTS

(Publication No. 21,882)

Shirley Lois Hopkinson, Ed.D.
The University of Oklahoma, 1957

Major Professor: Dr. Frank A. Balyeat

The purpose of this study is to discover the present status of audio-visual education programs in the public school districts of California. A detailed survey was made of the audio-visual programs of sixty-one selected districts which met certain standards. By these standards a district had to have either (1) a director who devotes half of his working time to the audio-visual department, or (2) a library of audio-visual materials, a director who spends at least one-third of his time on audio-visual duties, and plans for continuing and expanding their programs. Attention was given to resources, services, personnel expenditures, use, procedures, and programs.

Data were secured through the use of a comprehensive questionnaire mailed with the sponsorship of the California State Department of Education or through scheduled interviews with audio-visual personnel or other school officials for the purpose of filling in the questionnaires.

The principal findings:

1. Thirty-six per cent of the audio-visual directors stated that their collections of materials are sufficiently adequate to meet the normal needs of their schools promptly and efficiently and to allow adequate loan time.
2. Thirty-eight per cent of the districts have instructional materials centers which combine printed and audio-visual materials of instruction into one unit.
3. Evaluation and selection of new materials and equipment is made by preview groups of teachers and supervisors or audio-visual staff members in three-fourths of the districts surveyed.
4. In sixty-two per cent of the districts purchases of materials and equipment may be made at any time during the year as need arises. Purchases may be made only once a year in as many as twenty per cent of the districts.
5. In eighty-three per cent of the districts, films requested by teachers but not owned by the audio-visual departments are rented or borrowed from outside sources
6. In slightly over one-half of the districts, teachers are able to book materials as late as one month ahead of the showing date and to be fairly certain of receipt. In the remaining districts, they must book from six months to one year in advance.
7. Two-thirds of the districts issue printed or mimeographed catalogs of available audio-visual materials. Sixty-nine per cent of these issue revisions and new catalogs as needed rather than at fixed intervals. Annotations are included in over one-half of the catalogs.
8. Only twenty-two districts have full-time directors, but almost three-fourths, forty-four districts, have directors who give at least half-time to the audio-visual program.
9. There is a wide divergence between districts in the amount of audio-visual expenditure, with a range of from $0.14 to $5.40 per pupil.
10. Very few districts keep detailed records of the use of their materials and fewer still make use of such records in evaluating their programs.

229 pages. $3.00. Mic 57-3113

TECHNICAL AND PROFESSIONAL REQUISITES FOR THE MEDICAL TECHNOLOGIST

(Publication No. 21,708)

Edythe Marie Kershaw, Ph.D.
New York University, 1957

Chairman: J. Darrell Barnard

The Problem

The practice of modern medicine requires the auxiliary help of the clinical laboratory. Often, the decision of the physician, surgeon, or specialist rests largely, or entirely, on the results of laboratory tests performed by the medical technologist. It is obvious, therefore, that the tests may be performed with great accuracy and that the results must be dependable. This requires basic knowledges and specialized skills.

At the present time, the preparation for such work is diverse, ranging from a cursory apprenticeship training to a collegiate degree. But even here there is no curricular uniformity.

After close inspection of the present status, this investigator discerned the need for a study to determine the duties and responsibilities of medical technologists, and from these to establish standards (educational goals or objectives) for the evaluation of medical technology curricula.

Procedures

The procedures used in this study were directed toward a determination of standards which can be used to evaluate curricula in medical technology.

A prepared list of 965 duties and responsibilities, compiled from references in the field, was checked by the chief technologists of 112 standard hospitals in New York State for the (a) frequency of performance and (b) difficulty in learning to perform the duties.

Following this, a jury of laboratory directors evaluated the performed duties for (a) importance in diagnosis and therapy and (b) advisability of pre-service instruction.

The above ratings were then scored and the decile ranks computed in order to provide a convenient index of the relative status of each duty with respect to each criterion.

Having determined the duties and responsibilities of the medical technologist, the information and skills required for their performance were compiled from the references originally used in assembling the duties. These were graded by a jury of laboratory directors as (a) necessary (b) desirable or (c) unnecessary. The ratings given to the items were scored in order to determine their relative importance in the practice of medical technology.

Findings

This investigation disclosed the following:

(1) Of the 965 duties and responsibilities compiled from references in the field, 871 (90%), which differ widely in the significance assigned to them under the criteria of (a) frequency, (b) learning difficulty, (c) importance, and (d) value of pre-service instruction, are required for the practice of medical technology in standard laboratories. The 871 specific duties fall in nineteen broad categories of functioning in medical technology. These categories differ among themselves as to the number of high ranking duties they contain, some being more significant than others. Such findings suggest the need for placing corresponding emphasis in training on those categories having many high ranking duties.

(2) Of the information and skills compiled from the original references, 98.4 per cent were found to be necessary or desirable for the technologist to possess, in order to perform the activities safely and intelligently. This points to the need for inclusion in a training curriculum. Only 1.6 per cent were found to be unnecessary to the medical technologist suggesting that no provision needs to be made for them a training program.

Conclusions

The findings of the present investigation warrant the conclusions that:

(1) The duties and responsibilities of the medical technologist, as determined by an occupational analysis, are extensive and varied;

(2) The duties and responsibilities, as determined by the techniques used in this study, varied in terms of frequency of use, importance, learning difficulty, and desirability of pre-service instruction;

(3) The knowledges and skills required for performance of the duties and responsibilities of the medical technologist, as identified by this investigation are sufficiently discrete to serve as operational standards (educational goals or objectives) for the evaluation of medical technology curricula. 258 pages. $3.35. Mic 57-3114

RURAL-URBAN DIFFERENCES IN INTELLIGENCE

(Publication No. 22,382)

Irvin Jack Lehmann, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Chester W. Harris

The purpose of this study was to determine whether there is a significant difference (a) between rural and urban children, and (b) between boys and girls in grades one and six, in their responses to the individual items of Form L of the Revised Stanford-Binet, in IQ, or in MA.

Forty-four boys and forty-four girls who were white, native-born Americans with birthdates between June 1, and December 31, 1948 or 1943 (depending upon whether they were first or sixth graders) and free from any severe speech and sensory defects were selected at random from the population of such children in a county and in a city in southeastern Wisconsin. There 8 groups of 11 cases each constituted the sample.

Each subject was tested by the writer under relatively uniform testing conditions. The tests were then scored using the manual and supplement. To insure accuracy, the tests were rescored twice before the data were analysed.

To determine whether there was a significant sex or locale (rural-urban) difference in IQ, analysis of variance was used. The assumption of homogeneity of variance was tested by Hartley's $F_{max.}$ method and found tenable.

To determine whether there was a significant sex or locale difference in MA, analysis of covariance was used. The assumptions of linearity of regression and homogeneity of regression were found tenable.

To determine whether there was a significant sex or locale difference in the number of correct responses to the individual test items, chi-square was used. This analysis was done separately for the first and sixth grade subjects.

The findings of the study were as follows:

(1) The mean IQ of rural and urban children was 105.4 and 111.8 respectively. The difference is significant beyond the five per cent level.

(2) The mean IQ for boys and girls was 108.2 and 109.0 respectively. The difference is not statistically significant.

These results support the findings of early studies showing differences in IQ in favor of urban over rural children, and a negligible sex difference in IQ.

(3) For both the first and sixth grade subjects, more urban than rural children and more girls than boys answered more items correctly. The differences however, are not statistically significant. These findings do not support those of previous studies which have shown rural children to excel on non-verbal items, and girls to excel on verbal-type items.

(4) The mean MA for boys and girls was 118.7 and 118.4 respectively; for rural and urban children, the mean MA was 115.2 and 122.0 respectively. The differences are not statistically significant.

(5) None of the interactions --Sex X Locale, Age X Sex, Age X Locale, and Age X Locale X Sex were significant for either the IQ or MA scores.

(6) There is no significant sex or locale difference in the number of correct responses to the words of the vocabulary subtest.

(7) When the findings of the present study were

compared with those of the standardization sample, the six and eleven year-old subjects of the present study had a higher mean IQ than their counterparts in the standardization sample. The six year-old girls of the present study had a significantly (beyond the five per cent level) higher mean IQ than those used in the standardization.

In conclusion, the purpose of this study was to study the performance of present-day rural and urban children, and boys and girls on Form L of the Revised Stanford-Binet which was standardized in 1937. The findings support early studies showing differences in IQ in favor of urban over rural children and negligible sex differences in IQ. Further research needs to be conducted in an attempt to learn why these differences persist.

179 pages. $2.35. Mic 57-3115

THE STATUS OF PRIVILEGED COMMUNICATION IN THE FIELD OF COUNSELING, AS COMPARED WITH THE FIELDS OF LAW, MEDICINE, THEOLOGY, AND JOURNALISM

(Publication No. 19,278)

Robert Benjamin Nemeschy, Ed.D.
Indiana University, 1956

Chairman: Louis G. Schmidt

Counselor personnel are constantly confronted with the need to gain the complete confidence of their students so that they will feel free to completely share their problems with the counselor. Without a counselee's being able to completely confide in the trained counselor, because his confidences are not legally held inviolate, the counselor, if not prevented completely from performing his functions, is at least seriously handicapped.

The primary concern of this study was to determine whether or not a communication privilege, enjoyed by certain other professions, might be established for the counseling profession as a means of legal protection for the counselor and his client in their highly confidential relationship. "Privileged Communication" was defined by Henry C. Black in his Law Dictionary as: "in the law of evidence any communication made to a counselor, solicitor, or attorney, in professional confidence, and which he is not permitted to divulge; otherwise called a 'confidential communication.'" The basic hypothesis was that the counselor-counselee relationship qualifies for a legislative granting of a communication privilege at least to the same extent as the attorney-client, the physician-patient, the priest-penitent, and the journalist-informant relationships, which, in a number of instances, all enjoy such a privilege.

The professions of counseling, law, medicine, theology, and journalism were studied with regard to the status of a communication privilege in each, as well as the qualifications of each as a profession, by standards of definition, specialized educational training, and the governing of each by a special code of ethics. From the Dictionary of Education, Carter V. Good's definition of a "Profession" was accepted for this study, offering the following definition: "An occupation that requires relatively long and specialized preparation on the higher education level and that is governed by a special code of ethics."

Each of the five professions was also evaluated as to its qualifying for a communication privilege according to four conditions established by the foremost authority in the profession of law, John Henry Wigmore, as being necessary for the establishment and recognition of such a privilege. These criteria were: (1) The communications must originate in a confidence that they will not be disclosed; (2) this element of confidentiality must be essential to the full and satisfactory maintenance of the relation between the parties; (3) the relation must be one which in the opinion of the community ought to be sedulously fostered; and (4) the injury that would inure to the relation by the disclosure of the communication must be greater than the benefit thereby gained for the correct disposal of litigation.

Questionnaires were forwarded to the attorney general in each of the United States and to student personnel workers in all accredited, four-year, degree-granting colleges and universities in the six midwestern states of Colorado, Iowa, Kansas, Missouri, Nebraska, and Oklahoma. Opinions were solicited as to the need for state licensing or certification, criteria for trained counselors, actual experienced needs for a communication privilege, as well as the actual status of such a privilege in each state for the five professions under consideration and awareness on the part of the student personnel profession of state laws as they apply to the counselor and his relationship to the counselee.

The following conclusions were based on the results of that study: (1) It is apparent that at the present time the counseling profession does not enjoy the protection of a communication privilege and that information gathered in the counselor-counselee relationship can be subjected to court testimony if a warrant is issued for such testimony and if the counselor is placed under an oath to testify. (2) The lack of a communication privilege for counselors is not comparable to the professions of law, medicine, theology, and journalism, in which latter professions such a privilege has been legislated. (3) The counselor-counselee relationship is of such a personal and confidential nature that it at least compares favorably with the attorney-client and the priest-penitent relationships, and as such, is deserving of a communication privilege. (4) The legal profession would not generally favor extension of a privilege to counselors, but the student personnel profession would definitely favor such an extension and has experienced a need for this extension to a reasonably great extent. (5) Little, if any, research has been attempted in the counselor-communication privilege area. Student personnel workers appear to be generally unaware of the legal implications of their work. (6) The counseling profession could, through legislative action, qualify for a communication privilege in all states, at least so far as meeting the requirements for a privilege recognition as defined by the foremost legal authority, John Henry Wigmore. (7) Professional criteria should be established for the counseling profession, and recognition as a trained counselor. (8) Certification and licensing should be established by the profession of counseling itself, in a pattern similar or identical to that of The American Psychological Association. (9) A carefully developed code of ethics for the counseling profession should be established by a generally governing organization such as The American Personnel and Guidance Association.

101 pages. $2.00. Mic 57-3116

AN INVESTIGATION OF INSTRUCTIONAL PROBLEMS ENCOUNTERED BY BEGINNING SECONDARY SCHOOL SCIENCE TEACHERS IN THE PACIFIC NORTHWEST

(Publication No. 22,186)

John Stanley Shrader, Ed.D.
University of Washington, 1957

Supervisor: Dr. Homer Boroughs, Jr.

The purpose of this study was to determine the nature and causes of instructional problems encountered by beginning secondary school science teachers in the Pacific Northwest and to suggest possible solutions to the indicated problems.

In this survey, data obtained from interviews were used in preparing a questionnaire that was sent to general science, biology, physics, and chemistry teachers who had been teaching four years or less. Usable responses were received from 130 teachers in 108 schools in ninety-five school districts of Oregon and Washington.

The problems most frequently reported by the respondents were caused by inadequate and/or insufficient preservice training in science, varieties and/or numbers of daily preparations, insufficient time and/or place in school for daily preparation, large classes in general science and biology, lack of auio-visual materials and rooms adequately equipped for their use, lack of administrative interest and assistance, the necessity of moving from room to room to teach science, inadequately equipped classrooms, insufficient knowledge of teaching methods and techniques and pupil behaviour and learning.

Many teachers indicated that classrooms lacked adequate chalkboards, bulletin board space, bookcases, means of converting electrical current to desired amounts and voltages, space to permit movement of pupils, storage space, microscopes, sinks, hoods, electrical outlets, gas outlets, laboratory and demonstration tables. Schools and classrooms also lacked sufficient textbooks, supplementary textbooks, reference books, equipment and materials for laboratory work and demonstrations, library science materials and charts.

Principal problems of teachers concerning teaching methods and techniques pertained to teacher-pupil planning, providing modified work for the slow and superior learner, devising and using individual and class projects, planning and using demonstrations and laboratory work, and using field trips.

Difficulties related to pupil behavior and learning pertained to completion of assignments, homework, challenging superior pupils, slow learners failing to complete a minimum amount of work, improper use and neglect of equipment, failure to bring materials and specimens to class, and prior preparation for science work.

Many suggestions were made by the science teachers for solving the problems. Some of the suggestions required expenditures for science education. Others called for increased administrative interest and assistance, reorganization for school districts, better pre-service and in-service training, revised scheduling of science classes, improved organization of science and audio-visual departments, more teaching experience, greater utilization of local resources, reduction in varieties and/or numbers of daily preparations, and reduction in pupil-teacher ratios.

A number of recommendations pertaining to school administrators resulted from an analysis of the data and included providing an orientation program that would explain the philosophy of the school, school district policies, responsibilities of science teachers, sciences being taught in other classes, and equipment and facilities available for teaching science. Other recommendations were to establish a science budget and to expend certain amounts annually, to initiate curriculum planning aimed toward the development of a continuous science program (grades one through twelve), to require science teachers to prepare outlines of their science courses and to list demonstrations and laboratory work, and to assign a teacher to teach only those sciences in which he was adequately prepared.

The findings also indicated that the beginning science teacher could do much to improve his teaching by exploring, prior to the opening of school, procedures and policies of the school, by working with pupils as individuals, by planning effective work by obtaining materials related to science teaching. He could also improve by continuing preparation in the areas taught.

210 pages. $2.75. Mic 57-3117

EDUCATION, ADMINISTRATION

PATTERNS OF BEHAVIORAL CHARACTERISTICS EXHIBITED BY SCHOOL ADMINISTRATORS

(Publication No. 22,667)

Harold Wayne Gentry, Ed.D.
The University of Tennessee, 1957

Major Professor: Orin B. Graff

During the past six years the Department of Educational Administration and Supervision at the University of Tennessee has been involved in a research project designed to improve the preparation program of the department. The primary emphasis of this research project has been to define behavioral characteristics of effective school administrators and to develop these desirable characteristices in a preparation program. This emphasis on defining behavioral characteristics of school administrators led to the development of an instrument embracing behavioral characteristics which would portray both effective and ineffective school administrators. It was believed such an instrument would be of value in appraising the potential of an individual for school administration and would provide some insights into the problem of developing desirable behavioral characteristics in a preparation program for school administrators. The instrument, when completed, became known as the Tennessee Rating Guide and served as the data gathering instrument for this study.

The Tennessee Rating Guide was constructed to consist of six major divisions: (1) Interpersonal Relations, (2) Intelligent Operation, (3) Condition of Health, (4) Ethical and Moral Strength, (5) Adequacy of Communication, and (6) Operation as a Citizen. Under each division there were a number of items with each item consisting of a five point continuum. Each of the five points under the

items was a specific statement of a behavioral characteristic relating in varying degrees to the item heading. The items were so arranged that one end of the scale represented the most desirable statement of a characteristic and the opposite end represented the least desirable statement of a characteristic. The second and fourth statements of characteristics approached the two extremes on the scale, while the third or middle statement was representative of what was considered to be an average rating.

The specific purpose of this study was to determine if patterns of behavioral characteristics would emerge in an analysis of the data provided by respondents who utilized the University of Tennessee Rating Guide to rate effective and ineffective school administrators.

The study hypothesized that an analysis of the ratings of school administrators will reveal important patterns of behavioral characteristics. In these patterns:

A. Selected effective administrators will have certain common characteristics which tend to differentiate them from selected ineffective administrators.

B. Selected ineffective administrators will have certain common characteristics which tend to differentiate them from selected effective school administrators.

C. The ratings of both effective and ineffective administrators will vary widely on certain characteristics.

The data of this study were limited to the responses of fifty-five school administrators selected by professors of school administration in various sections of the country. Each of the fifty-five raters selected and rated an "effective" school administrator and an "ineffective" school administrator. After the completed ratings were returned the items of the rating guide were arranged so that characteristic five was the most desirable and characteristic one the least desirable.

The conclusions which emerged from this study are as follows:

1. The effective administrators rated had common characteristics which tend to differentiate them from the ineffective administrators rated.
2. A rating of four or better on the Tennessee Rating Guide characterized the effective administrator.
3. While the effective administrators possessed a core of common characteristics they varied in the possession of some characteristics.
4. The ineffective administrators rated had common characteristics which tend to differentiate them from the effective administrators rated.
5. A rating of three or less on the Tennessee Rating Guide characterized the ineffective administrator.
6. The ineffective administrators' ratings varied widely, especially within a one to three range on the Tennessee Rating Guide.

128 pages. $2.00. Mic 57-3118

RELATIONSHIP OF WEALTH AND INCOME TO FINANCIAL SUPPORT OF PUBLIC EDUCATION IN WISCONSIN

(Publication No. 22,371)

Richard P. Jungers, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Russell T. Gregg

Statement of Problem

This study examined values, incomes, and taxes of property to determine the equitableness of taxation for the support of education in Wisconsin. To do this, values and incomes from all sources, and taxes paid for all governmental purposes and for educational purposes, were examined.

The answers to six questions were sought. The questions were:

1. What is the value of "property taxed as property?"
2. What is the value of "property not taxed as property?"
3. What income is earned by various forms of wealth?
4. What taxes are paid by various forms of wealth?
5. What relationships exist between values, incomes, and taxes for all purposes?
6. What relationships exist between values, incomes, and taxes for the support of education?

Procedure

Information was gathered concerning values, incomes, and taxes for property in Wisconsin. Property was classified into two categories of wealth; "property taxed as property" and "property not taxed as property." The values, incomes, and taxes were estimated for each category. Incomes and taxes from sources "not attributable to property" were compared to incomes and taxes from property.

Secondly, relationships between values, incomes, and taxes for the property categories were studied. Relationships of income and taxes from sources "not attributable to property" were also examined. In studying relationships, taxes for all governmental purposes, elementary and secondary schools, and all educational functions were considered.

Results

Value of "property taxed as property" in Wisconsin in 1954 was $13,964,253,000. Value of "property not taxed as property" was $18,348,648,574. Because representative property in the "property not taxed" category duplicated some "property taxed as property," net wealth of Wisconsin was estimated at $29,182,871,574.

Income from "property taxed as property" in Wisconsin in 1954 was $2,216,189,000. Income from "property not taxed as property" was $526,840,366. These incomes included labor and entrepreneurial shares earned by property owners. Income "not attributable to property" was estimated at $4,580,000,000.

Taxes for all purposes, public elementary and secondary schools, and all educational purposes, respectively, in Wisconsin in 1955 were as follows: "property taxad as property," $915,430,720, $159,862,928, and $170,739,205;

"property not taxed as property," $85,716,551, $2,215,020, and $4,744,085; and sources "not attributable to property," $857,997,937, $19,227,604, and $41,181,303.

Relationships between values, incomes, and taxes were expressed as ratios and percentages. Following are the percentages which the value, income, and taxes of each source were of the total: (1) "property taxed as property," value, 47.9 per cent; income, 30.3 per cent; taxes for all purposes, 49.2 per cent; taxes for elementary and secondary schools, 88 per cent; and taxes for all educational functions, 78.8 per cent, (2) "property not taxed as property," value 52.1 per cent; income, 7.2 per cent; taxes for all purposes, 4.6 per cent; taxes for elementary and secondary schools, 1.2 per cent; and taxes for all educational purposes, 2.2 per cent. (3) "not attributable to property," income, 62.5 per cent; taxes for all purposes, 46.2 per cent; taxes for elementary and secondary schools, 10.8 per cent; taxes for all educational purposes, 19.0 per cent.

Conclusions

The conclusions were as follows: (1) Taxes on "property taxed as property" for all governmental purposes, and for educational purposes, were too great in comparison to taxes of other sources. (2) Taxes on "property not taxed as property" for the above purposes were too small in comparison to the taxes on "property taxed as property." (3) Taxes on sources "not attributable to property" for these purposes were too small in comparison to the taxes on "property taxed as property."

190 pages. $2.50. Mic 57-3119

A PLAN OF CHRISTIAN HIGHER EDUCATION FOR ARKANSAS BAPTISTS

(Publication No. 22,140)

Ralph Everett Kirkman, Ed.D.
North Texas State College, 1957

The problem in this study was to develop a comprehensive long-range plan for Arkansas Baptists to follow in meeting their needs in the area of Christian higher education. These needs were viewed in two ways: need as related to the purposes and philosophy of Christian higher education of Southern Baptists, need as related to the number of persons to be served.

The data were derived from the following sources: literature on higher education in general and Christian higher education in particular, conferences with Baptist educational leaders, official records of the Arkansas Baptist colleges, government documents, and data from two questionnaires.

Criteria for the establishment and/or maintenance of Arkansas Baptist institutions of higher learning were derived from a survey of criteria suggested by leading authorities as related to general population trends and the recent recruitment and enrollment trends of Arkansas Baptist institutions of higher learning.

The Christian higher education needs of Arkansas Baptists were determined in terms of Southern Baptist higher education needs in general as related to the Arkansas Baptist State Convention and in terms of the number to be served.

An analysis of the degree to which the Christian higher education needs of Arkansas Baptists are being met was determined. The following plan of Christian higher education was proposed:

A sufficient number of well located, fully accredited, liberal arts colleges of high academic and spiritual quality should be provided. These institutions should be equipped to adequately educate students preparing for church-related vocations, secular vocations in which there are significant opportunities for Christian influence and witness, and provision, insofar as is possible, for the initial college preparation for those preparing for specialized vocations such as engineering and medicine.

In addition to the educational opportunities offered by Arkansas Baptist institutions of higher learning, an effective program of student work should be promoted on non-Baptist college campuses where there are sufficient numbers of Baptist students to conduct such a program. This would involve an extensive expansion of the present plans and facilities of the Arkansas Baptist Student Union.

An effective co-ordinated program of guidance and recruitment is essential to the growth, development, and success of Arkansas Baptist Christian higher education. The advantages and facilities for Arkansas Baptist Christian higher education should be presented to the Baptist youth of the state in order to reach the majority of the students who would attend Arkansas Baptist institutions of higher learning if they were properly informed.

The plan, however, should secure the approval of the Arkansas Baptist State Convention before it is enacted. The interest of the Convention in its institutions of higher learning should be reflected not only by a vote of the Convention in regular session but also by adequate financial support.

The following recommendations were made: both colleges should inaugurate a self-evaluation study, the Arkansas Baptist State Convention should also inaugurate a continuous program of study in order to achieve and maintain an adequate program of Christian higher education.

185 pages. $2.45. Mic 57-3120

FINANCIAL POLICIES OF SIX MIDWESTERN PRIVATE LIBERAL ARTS COLLEGES

(Publication No. 22,174)

Burton Arthur Kolb, D.B.A.
University of Washington, 1957

A critical analysis of the financial policies of six Midwestern private liberal arts colleges constitutes the core of this study. The period under review was from 1940 to 1954 inclusive. Each institution was examined as an individual entity. Its financial history and the factors bearing upon the formulation of its financial policies were presented in case form. Each case was developed through frequent personal interviews with responsible officers of the institution as well as examination of its records.

The financial policies of each institution then were analyzed and evaluated from the standpoints of their congruity with objectives and their compatibility with relevant

circumstances. Where such policies were found to be wanting, satisfactory substitutes were suggested. Finally, the financial experiences and conditions of the six colleges were compared with each other and with those of private liberal arts colleges in general.

The extent of improvement in financial condition and in the ability to provide increased funds to support educational programs varied greatly among the six colleges studied. Increases in capital and reserves of all funds of the six colleges ranged from 43 to 303 per cent, whereas increases in educational and general expenditures per student ranged from 76 to 165 per cent.

These variations were related to factors peculiar to each institution. The most important of these factors were personal qualities of the administrative officers, particularly the presidents, and the economic status of alumni, friends, and student bodies. When financial experience was related directly to such factors and the compatibility of financial policies with these factors was determined, it became apparent that the peculiar factors and financial policies influenced the welfare of the institution to an even greater degree than general external economic and social factors, such as price level inflation or variations in the number of youths seeking higher education.

This study provides, by example, methods of research and analysis by which the financial policies of other institutions of higher education may be examined critically. The value of such examination, both by administrators and benefactors of these institutions is strongly suggested by the findings in the six individual case studies which comprise the body of the thesis.

570 pages. $7.25. Mic 57-3121

EDUCATION, ADULT

ROLES OF COUNTY EXTENSION AGENTS AS PERCEIVED BY COUNTY AGRICULTURAL COMMITTEE MEMBERS IN WISCONSIN

(Publication No. 22,320)

Lawrence John Biever, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Eugene A. Wilkening

PURPOSE

The purpose of this study was to determine the roles of the agricultural agents, home agents and 4-H Club agents as perceived by the county agricultural committee members in 30 counties of Wisconsin. Certain personal characteristics of the county agricultural committee members and county characteristics were associated with role perception. This study was a part of a larger project conducted by Eugene A. Wilkening which includes the roles of agents as perceived by the county extension agents.

PROCEDURE

The interview schedule was used to secure needed information and data from 112 county agricultural committee members, 30 agricultural agents, 30 home agents and 30 4-H Club agents. The schedule contained face data, open-end and structured questions. Content analysis was used to ascertain role perception from open-end questions. Weighted scores and ranks were compiled to obtain importance of items ranked by respondents.

CONCLUSIONS

Differences were presented in the three foremost perceived roles of each type of agent as perceived by the county agricultural committee members and by the agents.

Differences existed between the county agricultural committee members and the agricultural agents, home agents and 4-H Club agents in ranking of activities conducted by county extension agents.

Age, educational level, occupation, and tenure of county agricultural committee members tends to be associated with the perceived roles of county extension agents.

The perception of agents' roles varies between low and high income areas; between less urbanized and more urbanized areas; and between dairy and general farmers, for the three types of agents studied.

Agricultural agents are regarded as disseminators of information more frequently than home agents and 4-H Club agents.

Home agents and 4-H Club agents were regarded as teachers, educators, or demonstrators more frequently than agricultural agents.

The training of local leaders was ranked foremost as an important activity for home agents and 4-H Club agents while providing information directly was an important activity for agricultural agents as perceived by the county agricultural committee members.

The ranking of major functions of Extension Service and methods of communication; the rating of frequency of contacts with other agencies, groups, and individuals; and the rating of techniques in reaching urban people indicate differences in relation to the perceived roles of the agricultural agents, home agents and 4-H Club agents by the county agricultural committee members.

158 pages. $2.10. Mic 57-3122

A STUDY OF CITIZEN PARTICIPATION IN URBAN RENEWAL AND ITS RELATIONSHIP TO ADULT EDUCATION

(Publication No. 22,203)

Gerda Johanna Lewis, Ph.D.
Cornell University, 1957

A survey of citizen participation activities in the urban renewal program of the Housing Act of 1954 was made and presented against a general background in which the relationships between democracy, city planning, and adult education formed the focal point.

STATEMENT OF THE PROBLEM

The problem was one of assessing the importance of citizen participation in urban renewal, of examining and describing current programs of citizen participation, and of determining the role of public adult education in assiting with citizen participation in urban renewal.

PROCEDURE

After establishing a philosophical background of the need for citizen participation and adult education's role in social change, urban renewal with its citizen participation requirement was explained and current citizen participation activities were then examined.

A questionnaire, "A Survey of the Extent and Form of Citizen Participation in Urban Renewal," was sent to local urban renewal directors in ninety-one cities with urban renewal programs as of July 31, 1956, to obtain information on the current status of citizen participation activities.

A second questionnaire, "Public Adult Education Assistance in Urban Renewal Programs," was sent to public school adult education directors in the same cities, to determine the extent to which public school adult education facilities have been used in cooperation with citizen participation in urban renewal.

Both questionnaires were reviewed by competent authorities in urban renewal and adult education and resulting criticisms and suggestions incorporated into the final version of the forms. The analysis was made from a qualitative rather than a quantitative point of view.

CONCLUSIONS

Analysis of the survey data led to the following general conclusions:

Urban Renewal

1. Community-wide participation and participation by organized groups far outweighs participation at the neighborhood level.
2. Participation is generally confined to the stage of urban renewal where public support is needed for a specific project, and also at the execution stage of a project.
3. A predominance of informational and public relations techniques has resulted in a passive type of participation.
4. Before citizen participation can become more active and more representative of all segments of the population of the community, trained staff must involve people in urban renewal on a block-by-block basis, from the inception, through the planning, to the execution phase of urban renewal.
5. Greater liaison is needed between renewal officials and other municipal departments which might aid in citizen participation activities, such as health, education, welfare, recreation, and other community agencies in a position to extend educational assistance.
6. Citizen participation, still relatively undeveloped in most of the communities surveyed, must expand to include a more representative portion of the people of the community or urban renewal may not succeed in enhancing the well-being of the total community.

Public School Adult Education

1. It is currently ill-equipped to perform more than limited functions of assistance to urban renewal.
2. It is handicapped by a traditionalistic curriculum, hesitancy to expand programs except on request, lack of teachers of adults trained in adult education and community organization methods, and lack of funds.
3. It is not yet a dynamic force in community development programs.
4. Willingness of public adult education officials to cooperate with urban renewal points to the schools as a resource for educational assistance for urban renewal in the future.

449 pages. $5.75. Mic 57-3123

COMMUNITY COLLEGES FOR INDIA

(Publication No. 22,181)

Victor George Martin Pavamani, Ph.D.
University of Washington, 1957

Supervisor: George D. Strayer, Jr.

The purpose of this study was to examine the intermediate college plan in the light of a study of the community college movement in the United States and to try to discover what elements in the community college may be incorporated into the intermediate colleges, and, on the basis of the findings of the above inquiry, to develop a plan for organizing community colleges in India.

The political, social, and economic forces that have been operating on the Indian scene in recent years profoundly affecting Indian life in all its phases are strikingly similar to those that brought into being the junior colleges in the United States. The intermediate colleges proposed for India are to perform the functions of junior colleges in the United States. The arguments advanced for the formation of the junior colleges on grounds of educational principles are advanced in India for the formation of the intermediate colleges.

The intermediate college plan is defective in that it places undue emphasis on the preparatory function. The needs of the country arising from the influence of various political, social, and economic factors indicate that the terminal function should be the main function of the intermediate colleges. To make their services maximally effective, the intermediate colleges should provide efficient guidance to the students. The intermediate colleges should also assume the responsibility for adult education. The intermediate college thus expanded in its scope and functions will seek to serve the educational needs of the entire community. In view of the extended functions assigned to these institutions, it is appropriate that they should be called community colleges.

Community colleges in India will be an integral part of the secondary school system. These institutions may be formed in four different ways: by the addition of the intermediate years to the high school, by the reorganization of existing second-grade colleges, by the reorganization of the intermediate classes in the degree colleges, and by independent creation.

Three types of organization are possible for community colleges in India: the two-year type, and four-year type, and the seven-year type. For various reasons, the four-year type of organization is the most desirable type of organization for the community colleges in India.

There will be several obstacles in the way of organizing four-year community colleges in India, namely, the power of tradition, lack of public understanding of the new type of organization, and vested interests of administrators. The task of establishing community colleges in India will call for men of great vision and ability, men imbued with the spirit of the pioneer.

In view of the tremendous expansion of education that is expected in the near future and the pressing need for vocational education, large numbers of community colleges will be required in India. However, a beginning may be made with one community college in each district.

In view of the variety of courses provided by the community college and the heterogeneity of the student body in regard to abilities, interests, and needs, it is essential that guidance should form an integral function of the community college. Students will need educational guidance, vocational guidance, civic guidance, health guidance, social and moral guidance. The guidance function should include the following aspects: securing information about students, securing information about educational and vocational opportunities, supplying information to students, group and individual counseling, stimulating students to relate themselves in their thinking to these educational and vocational opportunities, following up the students after they leave the institution. There should be frequent evaluations of guidance services in the community colleges.

472 pages. $6.00. Mic 57-3124

EDUCATION, HISTORY

CHANGING CONCEPTS TOWARD THE CHILD AS A LEARNER

(Publication No. 22,146)

C. Larry Hagen, Ph.D.
University of Utah, 1957

Chairman: Calvin W. Taylor

Historians of education and of psychology usually have concerned themselves only peripherally with changes in concepts of the child as a learner, for that topic occupies an unassigned middle ground between the two disciplines. This paper presents changes as these have occurred, and further seeks pedagogical and psychological causes which are conspicuous in the larger developments of philosophy, science, politics or religion.

This paper shows that no effective consideration was given to the nature of the child as a learner until late in the eighteenth century. During the seventeenth and eighteenth centuries, man for the first time began to give serious thought to himself--to his place in nature, in society and in the world, and to his rights, duties, and privileges. This change occurred with the geographic expansion of the known world, the rapid growth of the sciences, the stimulating writings of such philosophers as Descartes, Locke, and Voltaire, and the diminishing authoritarian powers of the church and state.

As man began to study himself, he also began to consider his childhood origins. John Locke (1690) initiated this study by his denial that the mind is furnished ab initio with ideas. To him the mind was a tabula rasa, gaining ideas only from sensory experiences and from intellectual reflection on those experiences.

The consequences of Locke's revolutionary theory were threefold. First, the French sensationists (La Mettrie, Condillac) and subsequently the French psychopathologists (Itard, Seguin) and the Italian educator Maria Montessori stressed the importance of the education of the child's sense.

Second, the English associationists, the French rationalists, the Prussian, Herbart, and modern connectionists (particularly E.L. Thorndike) emphasized Locke's second source of ideas: reflection on and association of sensory experiences.

Third, and receiving greatest emphasis in this paper, a more general movement stemming largely from Locke emphasized the needs and growth of the child, as represented by Rousseau, Pestalozzi, Froebel, and modern progressive education.

In the United States, these three movements coalesced in the period 1885-1910 and merged with a number of other developments. The Darwinian theory of mind as interpreted by William James and John Dewey, the child psychology of G. Stanley Hall, the laboratory method initiated by Wundt in Germany, and the mental measurement movements coming from the work of Galton, Cattell, Binet, and Thorndike are considered. The final product was a change in concepts of the child learner so significant that teacher-training textbooks written in 1890 were completely anachronistic by 1910.

The twentieth century highlighted problems of practical importance to educators and of theoretical importance to psychologists. These include the development of the mental testing movement and study of the nature of intelligence, the significance of motivation and drive, and the relative importance of heredity and environment for child growth.

Contributions derived from the psychological schools of associationism, behaviorism, Gestalt, and psychoanalysis are analyzed. The sources and development of progressive education, and opposition to it, are examined. Findings in social psychology, anthropology, and other areas which contribute to our understanding of the child as a learner are presented. The startling changes which have occurred are highlighted by presentation of an analysis of both popular and technical literature covering the period 1890-1956.

From these sources have come our modern concepts of the child as a learner. Most briefly, it may be said that both parents and educators now realize that the school is made for the child, and not the child for the school.

299 pages. $3.85. Mic 57-3125

EDUCATION, PHYSICAL

A FILM FOR USE IN DEVELOPING ABILITY TO ANALYZE COMMON ELEMENTS IN SPORTS SKILLS

(Publication No. 22,078)

Margaret Elizabeth Everett, Ph.D.
State University of Iowa, 1957

Chairman: Jean M. Homewood

The purpose of this study was to develop a sound motion picture for use with the prospective teacher of physical education. It was designed to provide a basis for analyzing sports skills utilizing certain mechanical principles of motion. The emphasis was on elements which were common to many sports activities.

The principles illustrated in the film were those concerned with balance, giving force to an object and receiving force. The sports from which the skills used in illustrating those principles were taken were field hockey, soccer, volleyball, basketball, softball, badminton and tennis. The specific skills were chosen to meet three criteria: 1) those which would ordinarily be taught to a beginning group, 2) those which would illustrate the use of one of the principles to be presented, and 3) the error caused by poor use of the principle would be typical in the beginner's performance.

The film was developed in three sections: Principles of Balance, Principles of Giving Force to an Object, and Principles of Receiving Force.

The basic sequence within each section includes an introduction followed by animation drawings which are used to present the principles graphically, followed by a series of scenes which shows illustrations of the principles presented through their use in sport skills. Each sequence of scenes shows a skill performed correctly, first at regular speed and then in slow motion. Next is shown a slow motion scene of the same skill performed incorrectly because of poor use of the principle. This is followed by a regular speed scene, again showing the skill correctly performed with coaching suggestions given. An observation section was planned to be used with the film either for discussion purposes or for testing purposes. This section was designed to show errors which occur in skills other than those presented in the film, when the principles are not used effectively. Multiple choice questions were constructed for use with the section as a testing device. Free response answers on coaching suggestions might also be used. A teacher's guide was constructed for use with the film.

The film was evaluated by staff members and graduate students from three departments of physical education which train prospective teachers. The evaluation was made on the technical quality, content, value in selected courses, and possible uses within these courses. The film rated high on all phases of technical quality and content. It was judged to have the highest value in the following courses: sports methods, major techniques and kinesiology. The use of the film within a course was varied.

96 pages. $2.00. Mic 57-3126

AN ANALYSIS OF SELECTED PHYSIOLOGICAL VARIANTS AFFECTING THE BALLISTOCARDIOGRAM

(Publication No. 19,752)

William Edward McCubbin, Ed.D.
George Peabody College for Teachers, 1956

Major Professor: Solon Sudduth

The purpose of this study was to present and interpret 561 acceleration ballistocardiographic tracings, which were undertaken with the aim of extending our knowledge of the significance of ballistocardiography as a method of analyzing physical fitness, and of evaluating the effects of selected physiological variants on the ballistocardiogram (BCG). The Arbeit and Lindner Ballistocardiograph combined with a Sanborn Viso-Cardette recording device, was used in taking the BCGs.

The research was conducted in such a manner as to establish norms from such experimental samples as were at the writer's disposal, as well as to assemble comparative data from which the relationship of grades, forms, times, and amplitudes of BCGs could be analyzed in relation to selected physical variants. These physical variants include body type, body mass, anthropometric measurements, age, sex, exercise, training, physical fitness, and within limitations, neurological and orthopedic diseases.

The 561 BCG records selected for this research divide themselves into five categories: (1) 100 from young female university students; (2) 100 from young male university students; (3) 184 from trained athletes; (4) 68 from ex-athletes; and (5) 109 from orthopedic and neurological patients.

Conclusions of the Study

The following conclusions were derived from the research data of this study:

1. The systolic contraction force of the male heart is statistically significantly stronger than that of the female heart. However, within the two sex groups of university students, no significant differences were encountered in comparing their systolic contraction forces in relation to their height-weight ratios and their abdominal fat layers.
2. The BCG is capable of indicating the effect of exhaustive exercise upon the heart, and that cardiac reaction to physical exertion can be measured by grade, form, amplitude, time, and stability of the BCG.
3. The amplitude of the IJK complexes of the BCG of most well trained athletes will decrease after exercise.
4. Physical training directed towards development of physical endurance will improve the grade and form of the BCG.
5. There is a need for further investigation of athletic performance in relation to the diminution of amplitudes of the BCG as a result of training. The physiological cause of this is not yet fully understood.
6. Ex-athletes who continue physical training have better hearts than those who do not.
7. The cardiac component of physical efficiency varies in quality and extra-cardiac factors alone may at times determine the quality of muscular performance.
8. Superior BCG grades and forms before and after exercise are invariably indicative of a functionally capable heart.

9. The presense of a good BCG in men and women patients severely disabled by neurological and orthopedic illnesses indicates a relatively favorable prognosis, and vice versa. One of the possibilities inherent in the ballistocardiographic method is that it renders practicable to ascertain cardiac efficiency independent of neuromuscular fitness.

10. Amplitudes of children's BCGs are not smaller than those from adults, and further, large amplitudes are not uncommon in children, a conclusion which corrects beliefs previously held.

11. Physique and body size exert little or no influence upon the BCG, a conclusion which corrects beliefs previously held.

12. There is a tendency for the IJK complex of the BCG to decrease with age, although continued physical training tends to eliminate this trend.

13. The introduction of the BCG has significantly enlarged the scope of scientific inquiry into the action of the heart in health and disease.

163 pages. $2.15. Mic 57-3127

AN ANALYSIS OF THE AERODYNAMICS OF PITCHED BASEBALLS

(Publication No. 22,103)

Carl Warren Selin, Ph.D.
State University of Iowa, 1957

Chairman: Elmer C. Lundquist

The purpose of this study was to analyze the trajectories of pitched baseballs and to determine the causes of particular types of trajectories.

More than two hundred pitches made by fourteen pitchers of baseball teams in the Big Ten conference, were photographed by means of two high-speed cameras. The pitches which were photographed included fast balls, curve balls, sidearm curve balls, sliders, knuckle balls, and change-up pitches. Films upon which were recorded the complete trajectories of pitches were selected, and an analysis of each pitch was made in terms of the velocity and the rate of rotation of the ball.

From each category of pitch, six pitches were selected as follows: the pitch with the lowest velocity, the pitch with a velocity nearest the average velocity, the pitch with the highest velocity, and the pitch with the lowest rate of rotation, the pitch with a near-average rate of rotation, and the pitch with the highest rate of rotation. Each pitch was then analyzed in terms of direction of rotation, axis of rotation, vertical deviation, horizontal deviation, vertical forces, and horizontal forces.

An analysis of the data revealed the following findings:

1. The velocity for each pitch in each category remained constant.
2. The rate of rotation for each pitch in each category remained constant.
3. In general, balls that rotated in a clockwise direction showed positive vertical deviation and negative horizontal deviation; and balls that rotated in a counter-clockwise direction showed negative vertical deviation and positive horizontal deviation. The direction of deviation of the knuckle balls was not related to the direction of rotation.
4. Each pitch in each category showed vertical deviation or horizontal deviation or both vertical and horizontal deviation. None of the pitches followed the course which would be followed by a freely-falling body.

An analysis of the data substantiated the following conclusions:

1. The direction of deviation of a pitched ball is determined by the direction of rotation and the vertical angle of the pitched ball.
2. The amount of deviation of a pitched ball is determined by the vertical angle, the rate of rotation, and the velocity of the pitched ball.
3. In general, the forces which in one plane (i.e., vertical or horizontal) act upon the ball are inversely related to the forces which in the other plane (i.e., horizontal or vertical) act upon the ball.
4. The relation of air flow to the seams of the ball affects the magnitude of the deviation of the pitch.

108 pages. $2.00. Mic 57-3128

EDUCATION, PSYCHOLOGY

AN EVALUATION OF TEACHER ABILITY TO IDENTIFY MALADJUSTED CHILDREN

(Publication No. 22,582)

Gerald Philip Benson, Ed.D.
University of Colorado, 1956

Chairman: Dorothy M. Sherman

The purpose of this investigation was (a) to test the ability of teachers to identify children needing help, (b) to describe maladjustment operationally for teachers and thereby aid teachers in identifying such children, and (c) to compare the findings with the results reported in similar studies.

Thirteen fourth grade teachers with class enrollments totaling 392 pupils listed the names of fifty-seven pupils, 21 per cent of the boys and 8.7 per cent of the girls, as needing help. These teachers were further stimulated to observe their classes for maladjusted pupils by using descriptions of maladjusted behavior. An additional sixteen pupils were included making a total of seventy-three pupils identified as needing help. By these two procedures, teachers listed 18.6 per cent of the sample as needing help: forty-four boys (24 per cent) and twenty-nine girls (13 per cent). Boys outnumbered girls by a ratio of 1.8:1. Each teacher also expressed her judgment on the extent of help needed by those children which she had identified as needing help.

Case folders were developed for each of the seventy-three pupils. They included data obtained by group

administration of the social distance scale, "guess who" technique, California Test of Personality, selected pictures from the Michigan Picture Test, and the Visual Motor Gestalt Test. Additional information was obtained from the cumulative records, samples of work, and the teacher's statement of the pupil's problem.

Two psychologists with advanced degrees in clinical psychology and recent diagnostic work with children were selected to analyze the material in the case folders and to make judgments on each child's need for help. The judgments of the teachers were compared to the judgments of the clinicians by the contingency coefficient and analysis.

If a teacher judged a child to need psychological help, her judgment was, in the opinion of the clinicians, a valid one. Only three pupils who were judged by teachers to need psychological help were judged by both clinicians to be only slightly maladjusted and could therefore be helped sufficiently by the classroom teacher. Both clinicians believed more children needed psychological help than were so designated by the teachers. Teachers believed that one of two pupils identified needed psychological help whereas clinicians believed three out of four of the same pupils needed more than teacher assistance.

The use of descriptions of maladjusted behavior resulted in the identification of additional children who needed help, and the majority of these, in the judgment of both clinicians, needed psychological help. The majority of these were girls who were characterized by withdrawal tendencies.

The number of children identified who were characterized by withdrawal tendencies suggests that teachers recognize the possible seriousness of such behavior and supports the recent findings that teachers and clinicians are closely in agreement on the significance of behavior symptoms relating to withdrawal.

The percentage of children identified by teachers in this study (18.6 per cent) as needing help agrees closely with the findings of Andrew and Lockwood in the Michigan Mental Health Survey (19 per cent). Both groups contained children who were slightly maladjusted.

Teachers judged 10.8 per cent of the pupils to be more severely maladjusted and in need of psychological help. These percentages are similar to those reported by Wickman (7 per cent) and Rogers (12 per cent).

251 pages. $3.25. Mic 57-3129

A COMPARISON OF PERFORMANCE OF SUBNORMAL, NORMAL, AND GIFTED CHILDREN ON THE OSERETSKY TESTS OF MOTOR PROFICIENCY

(Publication No. 22,115)

Robert Lloyd Berk, Ed.D.
Boston University School of Education, 1957

Statement of the Problem

For many years the relationship between motor ability and intelligence has been a controversial issue. The major hindrance to a solution has been the lack of a good omnibus instrument to measure developmental motor proficiency, similar to the Stanford-Binet for the area of intelligence. The recent addition of the Oseretsky Tests of Motor Proficiency to the psychological test armamentarium, although heretofore a crude instrument, has offered countless possibilities for filling this need.

The problem then was to construct a psychometrically sound instrument, in terms of administrability, objectivity, and inherent validity, for the measurement of developmental motor proficiency, and, by means of it, to ascertain the relationship between measured intelligence and measured motor proficiency.

Method

The construction of the instrument for the measurement of motor proficiency (Berk Revision of the Oseretsky Scale) was accomplished by means of revising, adapting, and refining one of the previous adaptations of the Oseretsky Scale (The Lincoln Adaptation). The Berk Revision in its present form resulted from subjective modification coupled with empirical experimentation of all the items in the Lincoln Adaptation.

The relationship between measured motor proficiency and measured intelligence was tested by administering the Berk Revision of the Oseretsky to subjects in three criterion groups, composed of subnormal, normal, and gifted children (N-20 for each group), and analyzing the results. Selection of subjects was on the basis of Revised Stanford-Binet (Form L) scores, with age, sex, race, and absence of motor involvement due to brain damage held constant.

Results

1. Of the 88 items in the Berk Revision of the Oseretsky Scale, Chi Square showed that 41 significantly discriminated among the three criterion groups, and 34 did not.
2. The internal consistency reliability of the test was .854.
3. The inter-subtest correlations of the Berk Revision of the Oseretsky ranged from .131 to .720 with only two of the 15 correlations above .494.
4. The performance of the subnormal group was significantly lower (beyond the one percent level of confidence) than that of the normal or gifted groups on all subtests except Asynkinesia; the performance of the normal group was not significantly different from that of the gifted group on any of the subtests except Simultaneous Voluntary Movement, on which the gifted performed better (significant beyond the five percent level).
5. The correlation between the Berk Revision of the Oseretsky and the Binet was .241.

Conclusions

1. The low positive correlation between the Berk Revision of the Oseretsky and the Binet indicates that there is some relationship between measured motor proficiency and measured intelligence. This relationship, however, is due primarily to the observed difference in performance between the subnormals and normals, since there was very little observed difference in performance between the normals and gifted.
2. The reliability of the Berk Revision of the Oseretsky is considered to be average for motor tests in general.
3. Since the magnitudes of the inter-subtest correlations

were low, the six subtests of the Berk Revision of the Oseretsky are considered to be relatively independent; therefore, the inclusion of all six subtests in further research is warranted.

4. The Berk Revision of the Oseretsky Scale in its present form is judged to be a functional instrument for the measurement of motor proficiency.

5. Since the relationship betwen motor proficiency and intelligence is low, a test of motor proficiency will provide a useful adjunct in the diagnosis of human abilities and/or disabilities.

280 pages. $3.60. Mic 57-3130

A STUDY OF SEVENTH GRADE CHILDREN'S READING OF COMIC BOOKS AS RELATED TO CERTAIN OTHER VARIABLES

(Publication No. 22,073)

W. Paul Blakely, Ph.D.
State University of Iowa, 1957

Chairman: William Eller

There have been widespread suggestions, often made emotionally and with little research evidence, that the reading of comic books is associated with a variety of educational, cultural, psychological, and moral characteristics.

As evidence bearing on such suggestions, the following data were obtained for 323 seventh grade boys and girls in the public schools of Cedar Rapids, Iowa:

(1) From a series of three questionnaires, administered at approximately one-month intervals, a reported frequency of comic book reading for three non-consecutive weeks;

(2) Using the information in the questionnaires, a Comic Book Type Score for each child derived by applying to his reported comic book titles a classification based upon ratings of the Cincinnati Committee on Evaluation of Comic Books;

(3) From the same questionnaires, a reported number of library-type books read during three months;

(4) Total scores and six subscores on the SRA Junior Inventory, Form S, a check-list of personal problems;

(5) I.Q. scores from the Lorge-Thorndike Test of Intelligence, Non-Verbal Series, Level 4, Form A;

(6) Teacher scorings on the Haggerty-Olson-Wickman Behavior Rating Schedules A and B, designed to indicate behavior problem status and presence of characteristics found related to such status;

(7) From the Stanford Achievement Test, Advanced Battery, Form J, the following grade-norm scores: Reading; average of Language and Spelling; and average of Language, Spelling, Arithmetic Reasoning and Computation, and Social Studies (as a general index of school achievement). (The study population was reduced to 281 for this phase because certain children in one of the participating schools were withheld by the school from the achievement testing program.)

As a basis for evaluating the validity of answers on the questionnaires and for obtaining further insights, parents or other supervising adults were visited concerning thirty-five of the children.

The children were grouped according to their reported frequency of comic book reading into "Non-readers," "Light Readers," "Moderate Readers," and "Heavy Readers," and compared by means of the simple analysis of variance with respect to the other variables measured. They were then grouped according to their Comic Book Type Scores into "Non-readers," "Readers of 'Non-Objectionable' Comics," "Readers of a Moderate Proportion of 'Objectionable' Comics," and "Readers of the Highest Proportion of 'Objectionable' Comics," and the same set of comparisons made.

Subject to the limitations of the study, the following conclusions have been drawn:

(1) Seventh grade children who differ in comic book reading, either as to type (as defined) or as to frequency, do not differ correspondingly in (a) intelligence, (b) tested reading ability, (c) tested achievement in language and spelling, (d) tested achievement in an average of representative areas, or (e) behavior problem status as rated by their teachers.

(2) Seventh grade children who differ in comic book reading as to frequency do not differ correspondingly in reported personal problems on the SRA Junior Inventory.

(3) Seventh grade boys who differ in type of comic book reading (as defined) do not differ correspondinly in reported personal problems on the SRA Junior Inventory. Girls who read a moderate proportion of "objectionable" titles scored significantly higher in number of problems in one subdivision, "Things in General."

(4) Seventh grade children who read comic books with greatest frequency also read the most library-type books.

389 pages. $5.00. Mic 57-3131

A COMPARISON OF TWO METHODS FOR EFFECTIVE USE OF GUIDANCE PERSONNEL

(Publication No. 22,328)

Charlotte Christine Carey, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor A. H. Edgerton

THE PROBLEM

In recent years there has been much confusion concerning the specific roles of school staff members in the guidance of individual pupils. With the hiring of pupil personnel specialists, those guidance responsibilities previously performed by teachers and administrators have been too frequently shifted to these specialists.

Confusion about the guidance responsibilities of teachers, principals, nurses, and county guidance coordinators was apparent in the schools of San Diego County, California. The investigator was motivated to determine how this confusion could be eliminated through the achievement of teamwork in the guidance of individual pupils.

The major problem of the study was to determine which of the two experimental methods designed to gain teamwork could enable school personnel to assume their appropriate roles in the child-study phases of individual guidance.

PROCEDURES

Two experimental methods were compared to determine which one would prove more successful. Each of the two experimental methods included a pupil referral form and the procedure for gaining help from a county guidance coordinator. Method I was developed mainly by guidance specialists and administrators. Method II was developed primarily through in-service education activities by teachers with the aid of their principals and a guidance specialist. Involved in the study were 186 pupil referents, 277 teachers, and eighteen principals from the elementary schools of Northern San Diego County in California.

Informal measures, developed by the investigator to determine whether or not appropriate guidance roles were being achieved, are: (1) the number, nature, and sources of requests for guidance services; (2) the extent and nature of organized pupil data submitted with referral forms; and, (3) the activities engaged in and the amount of time spent by school personnel in studying individual pupils.

RESULTS

In comparing the results of the two experimental methods, it was evident that under Method II:

1. The number of requests for guidance help decreased by one-half; however, over twice as many pupil-studies were made.
2. Ninety-seven per cent of the requests were channeled through the principal.
3. The nature of the requests for help showed greater understanding, on the parts of teachers and principals, of child growth and development.
4. All of the requests for help with individual pupils were accompanied by data forms.
5. All data forms contained more complete and usable information items.
6. Teachers and principals were spending more time in studying individual referents, whereas, nurses and guidance specialists were spending proportionately less time.
7. The total time expended by the guidance team members in a single study was less than formerly, when the guidance specialist had assumed the total responsibilities for the study of referents.

CONCLUSIONS

After careful analysis of both experimental methods and their results, the findings of the study would support the general conclusion that Method II was much more successful in achieving effective use of guidance personnel. The roles achieved under Method II more nearly approximated the related literature descriptions of the guidance roles of the teacher, principal, nurse, and guidance specialist.

The achievement of the appropriate guidance roles by school staff personnel enables the specialist to achieve a more effective guidance role in such activities as: (1) doing guidance tasks which require training beyond that ordinarily expected of teachers and principals and (2) working with teachers and administrators through in-service education to strengthen their guidance skills and knowledges. 218 pages. $2.85. Mic 57-3132

THE RELATIONSHIPS BETWEEN DRIVING RECORDS, SELECTED PERSONALITY CHARACTERISTICS AND BIOGRAPHICAL DATA OF TRAFFIC OFFENDERS AND NON-OFFENDERS: A STUDY OF SELECTED PERSONALITY CHARACTERISTICS AND SELECTED BIOGRAPHICAL DATA OF MOTOR VEHICLE TRAFFIC OFFENDERS AND NON-OFFENDERS AND THE RELATING OF DIFFERENCES OBTAINED TO RECORDS OF THEIR DRIVING PERFORMANCE

(Publication No. 21,705)

Earl Davis Heath, Ph.D.
New York University, 1957

Chairman: Herbert J. Stack

During the past fifty years, as a result of motor vehicle accidents over one million deaths have occurred, and some eight millions of permanent disabilities and more than forty millions of temporary disabilities have been inflicted. Moreover, the accompanying economic loss probably is incalculable. There is considerable evidence to indicate that the primary cause of the majority of these traffic accidents lies neither in the vehicle as such, nor in the condition of the roadway; but rather, that it is to be found in that combination of personal factors which go to make up the driver. Accordingly, this investigation was undertaken for the purpose of gaining additional insights into selected personal factors as these relate to traffic offense involvement.

Data on selected personality traits, as measured by the Thurstone Temperament Schedule, and data of a biographical nature were collected on an Experimental Group of 763 traffic offenders and a Control Group of 195 traffic non-offenders, all of whom were licensed resident motor vehicle operators of the State of New Jersey.

Three of the seven areas of the test device and eight of the thirteen categories of biographical information investigated proved to be statistically significant in differentiating between the offenders and the non-offenders. Experimental subjects were found to rate higher than Control subjects on the Impulsive and Sociable Scales of the test, and lower on the Reflective Scale. Analysis of biographical information revealed the Experimental Group to have a higher proportion of individuals in the following categories: 1) 18 - 33 years of age, 2) unmarried, 3) high school or college non-graduates, 4) employment in capacities other than professional, managerial or official, 5) earnings of less than $5,000.00 per year, 6) more than one job held during the five-year period preceding examination, 7) termination of employment for reasons other than self-betterment, and 8) indicated driver education.

The multiple cutoff method was used to identify those personality traits and biographical data which, in combination, would provide maximum separation of the groups. Such separation was found, by the use of critical scores,

in the combination of the Impulsive and Sociable Scales and biographical information.

For purposes of relating test scores and biographical data to the actual occurrence of accidents and/or violations, the multiple cutoff method was used to identify those subjects of the Experimental Group whose data indicated them to be representative of extremes of adjustment. A direct relationship was indicated between degree of adjustment and traffic offense involvement.

From this investigation, it appears that the measurement of impulsive, sociable, and reflective traits is of value in differentiating traffic offenders from non-offenders, while the measurement of active, vigorous, dominant, and stable traits does not appear to provide significant differentiation. Also, it appears that differentiation between the groups may be obtained through investigation of those statistically significant biographical data identified above. Further, it appears that the degree of adjustment of the traffic offender is likely to be reflected in his accident and/or violation experience; i.e., the better his adjustment, the better his driving record, the poorer his adjustment, the poorer his driving record.

Test and biographical data found to be statistically significant may prove of value in the following situations: 1) the screening of license applicants and prospective drivers, 2) the assessment of in-service drivers for purposes of developing refresher programs, and 3) the development of driver improvement programs for the traffic offender.

212 pages. $2.75. Mic 57-3133

A STUDY OF RELATIONSHIPS BETWEEN HANDWRITING LEGIBILITY AND PERCEPTION ADJUSTMENT AND PERSONALITY FACTORS

(Publication No. 22,373)

Henry Kay Kaplan, Ph.D.
The University of Wisconsin, 1957

Supervisor: A. H. Edgerton

Problem

Handwriting legibility was correlated with form perception and pupil adjustment. Also, an attempt was made to obtain new information relating to the subject's concept of the handwriting task.

Procedures

The subjects were 144 fourth, sixth, and tenth graders, divided equally by sex and grade.

Two samples of a prescribed sentence were obtained from each subject. The first was produced under normal conditions; the second after the subject was asked to write better.

The subject chose what he thought was the better sample and rated that sample on an eleven-point scale. Each sample was also rated by three judges.

For the perception data, the following instruments were used: The Perception sub-test of the SRA Primary Mental Abilities test, a form discrimination task; The Bender Visual Motor Gestalt, a perceptual motor task; The Benton Visual Retention Test, a perceptual memory task. Scores in each of these tests were correlated with legibility ratings.

Subjects were rated by their teachers on the Rating Scale for Pupil Adjustment. A Total adjustment score based on the ratings of four items was obtained. These ratings were correlated with legibility. Also, scores on other rated items were correlated with legibility.

In the area related to concept of the handwriting task, good and poor writers were compared with respect to (1) the accuracy with which they rated their own writing; (2) the amount of improvement made between the first and second samples; (3) the increase in time taken between the first and second sample. Time for writing the first, or normal, sample was correlated with legibility, and correlations were obtained between the time increase and the amount of improvement.

Results

(1) Bender performance was more highly correlated with legibility than was performance on the Benton or the Perception test. Correlations between the Bender and legibility were significant at the .05 level or better in three groups of subjects. Correlations between legibility and Benton and Perception scores were generally positive but not significant. (2) Total adjustment correlated significantly with legibility in only one group (.05 level for sixth-grade girls). Individual rating items yielding more significant correlations were Motor control and stability, School achievement, School conduct, Planning ability, and Neatness. (3) Good writers rated their legibility more accurately than did poor writers. (4) Poor writers made greater improvement between the first and second samples. At the tenth-grade level this difference in improvement was significant at a level approaching .001. (5) Good writers increased the time taken between the first and second samples slightly more than the poor writers. The difference was not significant. (6) Correlations between time taken and legibility were near zero in all groups. (7) Correlation between time increase and improvement was .416 for the sixth grade group as a whole, significant at the .01 level.

Conclusions

In addition to the conclusions that are implied by the above results, several conclusions based on the overall findings are put forth. There was considerable variability in the findings, from grade to grade and between sexes. Yet, the correlations almost without exception, were higher in the sixth-grade girls group than in all other groups. Handwriting is viewed as a more predictable phenomenon in that group. Sixth-grade girls could be viewed as a more heterogeneous group or as a group in which greater differences exist in the various areas investigated.

The above and tenth-grade poor writers' great ability for improvement when so requested suggested interpretations emphasizing the importance of motivational and cultural factors. It was concluded that handwriting might be viewed as a different type of phenomenon at different grade levels.

109 pages. $2.00. Mic 57-3135

AN INVESTIGATION OF THE CULTURAL BIAS ISSUE IN INTELLIGENCE TESTING

(Publication No. 22,087)

Lotus Mae Knief, Ph.D.
State University of Iowa, 1957

Chairman: James B. Stroud

Since the early history of intelligence testing it has been known that intelligence scores of school children correlate positively with social class status. Within the last decade or so a number of critics have advanced the argument that this relationship results from cultural bias in the prevailing intelligence tests.

It is important to know whether the association between intelligence and social class is genuine, or results from cultural bias inherent in the intelligence tests.

An important group of workers has devoted several years to research on this problem. Upon the basis of this research an intelligence test was developed featuring content common to all or nearly all children in our society. This represents a frank attempt to design a culture-fair test.

Other authorities have suggested the association between social class and intelligence scores may be genuine, and that it might be impossible to design an intelligence test, no matter how culture-fair, that would correlate satisfactorily with school achievement and would not reveal social class differences.

The purpose of the study was to investigate these issues by determining the interrelationships among social status, academic achievement, a culture-common intelligence test, and intelligence tests of more traditional design.

The sample consisted of 344 fourth-grade pupils, representative of fourth-grade pupils in a large city school system. Social status measures were determined using the Index of Status Characteristics. Three primary ratings --father's occupation, house type, dwelling area-- were weighted and combined for each pupil. Achievement measures were the Iowa Tests of Basic Skills. Scores used were: Reading Comprehension, Vocabulary, Work-Study, Language, Arithmetic, and Composite. The Davis-Eells Test of General Intelligence or Problem-Solving Ability, Elementary - A, was used as the culture-fair test; the Lorge-Thorndike Intelligence Tests, Verbal, Level 3, Form B, and Nonverbal, Level 3, Form A, were used as tests of the traditional type.

Means and standard deviations of the scores achieved by the sample on the three intelligence tests, the Index of Status Characteristics, and Iowa Tests of Basic Skills were typical of fourth-grade pupils in the country as a whole.

Social status correlated significantly and to approximately the same degree with each of the intelligence tests and with the achievement scores. The Davis-Eells test related significantly to status no less than the Lorge-Thorndike tests, despite its culture-common content. However, its correlation with the measures of achievement was significantly lower (.568 with ITBS Composite) than that of the Lorge-Thorndike Verbal test (.839 with ITBS Composite) and the Lorge-Thorndike Nonverbal (.683 with ITBS Composite). The Davis-Eells, a non-reading test, correlated substantially with the Reading Comprehension subtest. The relationship for the Lorge-Thorndike Nonverbal test was significantly higher.

The Lorge-Thorndike Verbal test surpassed by far the other variables in the prediction of composite achievement and showed no greater relationship to social status. Combining this test in a multiple correlation procedure with other measures improved prediction so little as to be impractical.

The claim that the more traditional type of verbal intelligence test is flagrantly biased culturally was not upheld by the findings of this investigation. However, its superior serviceability in the prediction of achievement was well sustained. The results suggest that verbal symbolism as such does not cause a significantly higher association of intelligence scores with status, and that attempts to reduce differences by avoiding its use may produce tests less competent for customary school practices. The results of this investigation are not incompatible with the thesis that the association between intelligence scores and social class status is genuine.

103 pages. $2.00. Mic 57-3136

ACADEMIC FORECASTING IN THE TECHNICAL-VOCATIONAL HIGH SCHOOL SUBJECTS AT WEST SEATTLE HIGH SCHOOL

(Publication No. 22,176)

James Robert Long, Ed.D.
University of Washington, 1957

Supervisor: Dr. August Dvorak

Objectives of the Study

The main objectives of the study were to analyze the relationships between various junior high school data and subject marks in the five technical-vocational high school areas, and to devise a method of forecasting academic success in each of these areas.

The method was to gather and process the junior and senior high school data for a large number of students to obtain the zero-order correlation coefficients between the different variables, and then to compute multiple correlation coefficients, regression equations, and other correlational data.

The junior high school data included the grade averages in language arts, mathematics, social studies, science, industrial arts and home economics, as well as the standardized test scores from the California Reading Test for reading vocabulary and reading comprehension and I.Q. test scores from the Otis Quick-Scoring Test of Mental Ability and the Science Research Associates Primary Mental Abilities Test.

The criteria were senior high school grade point averages in the following technical-vocational areas: mathematics, science, business education, industrial arts and home economics.

The data were processed separately for boys and girls to show the differences by sex with the hope of improving the accuracy of the predictions.

Results

The multiple R's and regression equations computed for each area when using all eight independent variables

did not improve significantly the forecasting accuracy obtained by using only the three best predictors. The author recommends the use of three predictors in all areas except business education for boys and home economics for girls. For these two areas, the best single predictor is nearly as accurate as are multiple predictors. If the eight predictor batteries were to be used, it would be necessary to employ IBM equipment. The tables included in this study for single and for three predictors enable rapid forecasting without special equipment.

The multiple $\bar{R}$'s using eight predictors ranged from .38 for industrial arts to .64 for science for boys. The range for the same subjects using three predictors was from .39 to .62. The standard errors of estimate ranged from .90 to .65 using eight predictors and .89 to .66 using three predictors for the same respective subject areas. None of the results provided forecasting data as effective as desired. One of the limiting factors in all areas seemed to be the unreliable grading system on both the junior and senior high school levels.

The independent variables were effective in varying degrees. The best over-all predictor of success for boys and girls was grade point average in junior high mathematics. Junior high social studies grade point average contributed significantly for boys but not for girls. Junior high school science grade point average was the poorest independent variable, being of practically no value except in forecasting success in high school science.

Reading vocabulary scores provided very little toward the prediction of high school success, whereas reading comprehension scores constituted one of the best predictors. I.Q. score was not as good an over-all predictor for boys and girls as were mathematics grade point average or reading comprehension score.

Recommendations

It is recommended that the three-predictor battery regression equations be employed for forecasting success in all of the technical-vocational high school subject areas except business education for boys and home economics for girls. The use of the best single predictor is recommended for these two areas.

It is recommended that the use of the I.Q. score as a predictor of academic success be discontinued in favor of more meaningful variables in the different subject areas. For example, in the area of high school mathematics the best independent variables were junior high school mathematics grade point average and reading comprehension score.

Since reading comprehension scores contributed far more toward predicting high school success than reading vocabulary scores, it is recommended that test results be recorded for these subscores rather than by total reading score.

It is further recommended that these data and other findings of the study be used by counselors for more effective counseling. 249 pages. $3.25. Mic 57-3137

CHANGES IN THE SOLUTION OF ADOLESCENT TASKS BY ELEVENTH GRADE BOYS DURING ONE YEAR AND IN TERMS OF SOCIO-ECONOMIC STATUS

(Publication No. 22,136)

Suzanne Nelson, Ph.D.
The University of Nebraska, 1957

Adviser: Dean A. Worcester

Purpose

The purpose of this study was to determine if there were significant changes in the success of a group of high school boys during an academic year in their solution of developmental tasks and to investigate the relationship between their success in such solutions and the socio-economic status of their homes.

Tests Administered

The McCleery Scale was administered to 204 boys two years in succession to measure their success in the solution of developmental tasks. The Sims Score Card was administered to assess the socio-economic status of their homes.

Results

It was revealed that for the entire sample the changes which took place in every area were in the direction of more maturity, according to McCleery's interpretations. There were significant changes in the direction of maturity in the solution of developmental tasks in

Area I	Peer Relations
Area III	Physique Acceptance
Area V	Economic Independence
Area VI	Occupational Preparation
Area VII	Family Life
Area VIII	Civic Competence
Area IX	Social Responsibility
Area X	Ethical System
Total	Scores taken as a whole

After dividing the youngsters into socio-economic groups it was revealed that not all changes within these groups were in the direction of more maturity.

No students fell within Group I.

Group II Students in this group showed no improvement in the success in solving developmental tasks within Areas III, IV, V, VI, IX, and X. All areas but one, however, had mean scores which were higher than the average score of the "mature" group as indicated in the McCleery Norms. The second administration mean score in Area V, Economic Independence, was below the average score of the "mature" group.

The changes made in the total maturity within this group were not great enough to be significant.

Group III The students within this group showed improvement in all of the ten areas and the total in the solution of developmental tasks.

The changes for the total maturity of this group were significant.

Group IV The students within this group showed improvement in all of the ten areas and the total in the solution of developmental tasks.

The changes for the total maturity of this group were significant.

Group V Students in this group showed no improvement in the solution of developmental tasks in Areas VI, VII, and X. The changes in the remainder of the ten areas and in the total showed improvement in the solution of the developmental tasks.

The changes for the total maturity of this group were not great enough to be significant.

By comparing the top fifty and bottom fifty students socio-economically it was revealed that the changes as represented by mean scores within the top group were in the direction of more maturity in every area. Students within the bottom group showed no improvement in the solution of developmental tasks in Areas II and IV. In the top group the changes within Areas I, III, V, VII, VIII, IX, X and the Total were great enough to be significant. Area VII, Family Life, Area VIII, Civic Competence, and Area IX, Social Responsibility, were the only areas with significant changes in the bottom group.

Although the second administration scores in some of the areas did not move in the direction of more maturity there is only one area which reveals a low mean score. Area VII, Family Life, reveals a mean score below the average of the "immature" group, within socio-economic Group V.

The results obtained in this study may be different from results obtained elsewhere with the McCleery Test. South High School, due to its size of approximately 2700 students and its Gudiance Program may provide an environment different from that found in other school situation.

103 pages. $2.00. Mic 57-3138

TEACHING SATISFACTION IN RELATION TO INTELLIGENCE, INTERESTS, AND GRADE-POINT AVERAGE OF SELECTED UNIVERSITY OF GEORGIA GRADUATES

(Publication No. 22,153)

Ila Rooks, Ed.D.
University of Georgia, 1957

Supervisor: Dr. Karl C. Garrison

This study evaluated teachers' attitudes by investigating teaching satisfaction in relation to intelligence, interests, and academic performance. The reactions to the total position and selected on-the-job factors were secured by means of a questionnaire. The subjects consisted of selected 1949-1954 University of Georgia graduates of the College of Education for whom comparable standardized intelligence-test and interest-inventory results were available. Data for these respondents were treated statistically to determine the following: (1) the significance of the difference between means of all the variables for groups Who Now Teach; (2) the coefficients of correlation between variables for groups Who Now Teach; (3) the significance of the difference between means on certain variables for (a) Those Who Now Teach, (b) Those Who Have Taught, and (c) Those Who Have Never Taught.

Comparisons of satisfaction with the total teaching position among groups Who Now Teach indicated that the Elementary-School Sample was significantly better satisfied than other groups now teaching. Females were significantly better satisfied than males with areas related to teaching. Favored significantly on intelligence test results were the Male Sample and the Secondary-School Sample. The Elementary-School Sample, however, had a significantly higher grade-point average. The professional-course average did not discriminate among the groups Who Now Teach.

No significant correlations were found between job satisfaction and intelligence for the Total Sample of Those Who Now Teach and for the various sub-groups. There were no significant correlations between grade-point average and job satisfaction. Neither were there any significant correlations between professional-course average and job satisfaction. The only significant correlations between interest and satisfaction with the total teaching position were between the interest Computational Scale and satisfaction for the Total Female Sample and between the interest Literary Scale and satisfaction for the Total Male Sample.

The one significant correlation between satisfaction with areas related to teaching and professional-course average was for the Total Male Sample. The only significant coefficient of correlation between interest and satisfaction with areas related to teaching was a negative one on the interest Mechanical Scale for the Total Female Sample.

An analysis of the educational and psychological profiles revealed that Those Who Have Never Taught were favored significantly on the intelligence test results and had significantly greater mechanical interest. The Males Who Now Teach had significantly greater social service and Literary interests than drop-outs or Those Who Have Never Taught. The females remaining in teaching also had significantly greater literary interest than the drop-outs or Those Who Have Never Taught.

The data in this investigation indicated that the following hypotheses were rejected: (1) Teaching satisfaction bears a significant relationship to scores on the Social Service Scale of the Kuder Preference Record, Vocational Form C; (2) Teaching Satisfaction bears a significant relationship to the Language, Non-Language, and Total scores on the California Short-Form Test of Mental Maturity, Advanced '47 S-Form; (3) Teaching Satisfaction bears a significant relationship to professional-course average. Slightly supported was Hypothesis No. 5 that those graduates who remain in teaching have a different educational and psychological profile from the ones who change to other occupations.

180 pages. $2.35. Mic 57-3139

A STUDY OF ADMISSIONS AND RETENTION PRACTICES IN COLLEGE AND UNIVERSITY PROGRAMS OF TEACHER EDUCATION

(Publication No. 22,487)

Ruth Albertine Stout, Ph.D.
University of Minnesota, 1957

The present study surveys selective admissions and retention practices in teacher education, and analyzes the

relation of these programs to various institutional characteristics and to the actual production of teachers. Sponsorship of the study by the American Association of Colleges for Teacher Education and the National Commission on Teacher Education and Professional Standards resulted in exceptionally fine cooperation. Basic data regarding teacher education programs were secured from 785 generally-accredited institutions (91 per cent of the population), through a 31-page questionnaire.

In addition to yielding a description of opinion and current practice nationwide, the data provided bases for testing these hypotheses:

1. There is no relationship between any of five selective admissions practices in teacher education and institutional characteristics of (a) geographic location, (b) type - support and control, organization and structure, degree programs of teacher education - and (c) size - total institutional enrolment, total teacher education enrolment.
2. There is no relationship between any of six selective retention practices in teacher education and the institutional characteristics as specified above.

Both null hypotheses were rejected, for within each classification from five to eight of the possible eleven differences were found significant at the .01 level of confidence when the Chi Square or percentage tests of significance of differences was applied. Though no cause-effect relationship is implied, a justifiable conclusion is that a relationship exists between selective procedures in teacher education and various institutional characteristics. The more extensive selective practices were found in programs of preparation for elementary-school teachers, in large public institutions, and among institutions in the Western College Association area.

The 189 most extensive and the 182 least extensive programs were further studied to test the hypothesis that there is no relation between selective practices in teacher education and institutions' output of teachers as measured by: (a) per cent of students who complete the program, and (b) per cent of graduates who enter teaching the following year. This null hypothesis also was rejected because institutions in the selective group were found to be significantly better producers, in terms both of graduates and their placement in teaching positions. Repeated evaluation of students' emotional stability and of communication skills characterized the programs of all 189 top institutions, but such evaluations were infrequent or non-existent among institutions in the low group.

The following practices appear to characterize consistently functioning selective programs; (1) special requirements for admission and continuance; (2) evaluation of emotional stability, personal-social-ethical fitness for teaching, and communication skills, at three or more points in the student's preparation, along with evaluation of academic ability and physical fitness; (3) review of each case at stated intervals, with interviews, and faculty committee evaluations as elements in the review procedure; (4) consistent efforts to relate the student's interests and abilities to job opportunities; and (5) a continuing program of follow-up of graduates.

Respondents generally considered selective programs for teacher education desirable and practical. Evaluation of emotional stability was identified by most respondents as being of primary importance in any selective program, though evaluation of academic grades was used by more institutions than any other procedure.

Some selective procedures are employed in three-fourths of the institutions; three-fifths reject some applicants for teacher education; two-thirds refuse student teaching to some persons. Analyses reveal defensible practice, questionable practice, complete absence of selective procedures, and extreme lag of practice behind belief.

The positive effect of sound selective programs on quality has been assumed. The present study provides evidence of a positive relationship between selective programs and quantity of production. Efforts to extend and improve programs of selective admission and retention for teacher education should therefore be greatly accelerated. 348 pages. $4.45. Mic 57-3140

THE SELF PERCEPTIONS AND THE PERCEPTIONS OF OTHERS OF ADOLESCENT LEADERS ELECTED BY THEIR PEERS

(Publication No. 22,488)

Roger Edward Wilk, Ph.D.
University of Minnesota, 1957

The purpose. The purpose of the study was to test certain self theory constructs as an approach to the understanding of leader behavior. Two sets of hypotheses were formulated from the basic tenets of self theory. One set was formulated from the construct which states that an individual's behavior is a function of his perceptions of self and of the situation. The other set was based on the assumption that an individual's perceptions of self are a function of his system of values.

The sample. Five troops of adolescent scouts (n=168) who participated in a five week leadership training program in a national scout camp during the summer of 1955 were the subjects of the study. The program provided a coordinated schedule of standardized activities for each troop in which all scouts had equivalent opportunities to practice leadership skills. On the basis of peer judgments of proficiency in the program, each scout was placed into one of three leader categories, the "elected," the "certified," or the "rejected." These leader categories were the criterion groups for the study.

Procedures. The first hypothesis set stated that peer elected adolescent leaders would perceive themselves and be perceived by the group as being more able to supply essential leader behaviors for the group than those not elected. As measures of self and other perceptions of leader behaviors, peer rankings of three behaviors were obtained after members of the troops had been acquainted for one week and again after four weeks. Ability to influence, performance of scouting skills, and ability to raise morale were specified as the three essential leader behaviors. A self ranking score and a mean troop ranking score were obtained from normalized rankings. A four dimension classification design assuming different correlations between the levels of two of these dimensions provided the model for the analysis of variance of hypotheses of differences among the means of leader categories,

troops, leader behaviors, length of acquaintance and interactions among the variables.

The second hypothesis set stated that peer-elected adolescent leaders would perceive 1) their own behavior, 2) the behavior of the ideal leader, and 3) the behavior of the average scout as more closely resembling the established values of the group than would those not elected. To assess perceptions of the established values of the group the Index of Scouting Values was constructed. Thirty adjectives and phrases descriptive of interpersonal behaviors were constructed to provide a valid representation of the Scout Laws. Each scout reacted to the adjectives in terms of the three perceptions specified in the hypotheses. A two-way analysis of variance model was used to test the differences among the means of leader categories and troops on the three scores.

Conclusions.

1. "Elected" leaders perceived themselves and were perceived by the group as being more able to supply essential leader behaviors than the "certified" or the "rejected."

2. Differences between the self rankings made after one and four weeks of acquaintance showed statistical but not practical differences for all criterion groups. In contrast mean troop rankings of the "elected" increase over time while those of the "rejected" decreased producing a statistically significant interaction.

3. The results indicated that the five troops were not random samples from the same population and suggest that self and mean troop rankings were a function of the group situation.

4. Peer rankings were found to be a reliable and effective means of assessing interpersonal perception and reflected the existence and importance of social comparison processes.

5. Analyses of the three scores from the Index of Scouting Values showed no differences among the three criterion groups. 147 pages. $2.00. Mic 57-3141

EDUCATION, TEACHER TRAINING

A SURVEY OF SELECTED INSERVICE PRACTICES IN MINNESOTA PUBLIC SCHOOLS WITH IMPLICATIONS FOR THE ORGANIZATION OF INSERVICE EDUCATION ACTIVITIES

(Publication No. 22,441)

Irvamae Vincent Applegate, Ph.D.
University of Minnesota, 1957

Purpose and Method

A questionnaire survey in a twenty-five per cent stratified random sample of Minnesota public schools was used to secure information relating to the status and organization of certain inservice activities: the pre-school workshop, teachers meetings, teachers handbooks, and the extent to which schools had salary schedules and their requirements for inservice activity.

An opinion item was included requesting respondents to indicate from ten areas those in which they thought teachers are generally strong or generally weak, and whether they thought these areas could be developed through inservice activity at the local level. The ten areas for consideration were: the administration of standardized tests, the interpretation of standardized tests, the use of cumulative records, the use of new instructional materials, conducting parent-teacher conferences, conducting student-teacher conferences, the use of new instructional techniques, public relations, participation in community activities, and the use of guidance techniques in the classroom. Respondents were also asked to indicate whether they thought these areas could be developed through inservice activity at the local level.

Questionnaires were sent to three types of individuals in each school--administrators, elementary and secondary teachers. A 50 per cent random sample of non-respondents was contacted, responses compared by chi-square to those of respondents. No differences were found and the results were pooled.

Findings are based on a 95.8 per cent return from administrators, 92.3 per cent from elementary teachers and a 89.1 per cent return from secondary teachers on fact items.

Summary

The number of pre-school workshops has steadily increased, with significant increases in 1955 and 1956. Over 60 per cent of the schools in the sample reported workshops in 1955, almost 75 per cent anticipated having preschool workshops in 1956. The mean length of pre-school workshops was 2.8 days. Explanation of schedule, school policy, and discussion of instructional materials are most frequently found on the workshop agenda. The workshop is planned primarily by the administration and is not rated very high by teachers as an inservice device.

All schools reported teachers meetings, with the common pattern being meetings called after school, lasting about one hour, consisting most often of "informal discussion" and least often of "planned discussion," usually planned and conducted by the administration. None of the groups of respondents rated teachers meetings as effective devices for inservice education.

Teachers handbooks are found in about 50 per cent of the schools in the sample, 42 per cent of those not having handbooks plan to develop them. The administration usually prepares them, they usually contain information relating to administration. All teachers ranked the handbook within the top three of twenty-five inservice practices.

Salary schedules were reported by over 60 per cent of the schools in the sample, with over 90 per cent of them recognizing some type of course work as acceptable for advance on the schedule.

Conclusions

1. The pre-school workshop is increasing in numbers but the organization and rating raises some question as to its effectiveness as a device for promoting inservice growth.
2. Teachers meetings are probably not very effective in promoting inservice growth, as now conducted.
3. The potential of the teachers handbook as an inservice device is being overlooked by administrators.
4. Principal emphasis is being placed upon course work for promoting inservice growth as evidenced by salary schedule provision for such work.

5. Teachers recognize and point out areas of weakness, which possibly indicates a readiness to work on these areas.
6. Respondents feel that the areas of weakness can be developed through inservice activity at the local level.
7. There is no pattern of relationship between opinion regarding the strong or weak areas and the respondents' training, experience, or the size of the staff of which the respondent is a member.
8. Size of the school faculty is more closely related to certain inservice practices than is school organization.
9. In general, certain inservice practices are more frequently found in schools with 6-3-3 type of organization than in any other type of organization.

298 pages. $3.85. Mic 57-3142

THEORETICAL TOPICS IN MATHEMATICS AT THE EIGHTH GRADE LEVEL

(Publication No. 22,322)

John Arthur Brown, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Edward Krug

The purposes of this study are to (a) identify principles and definitions related to eighth grade arithmetic, (b) describe the organization of topics developed from the principles and definitions, (c) illustrate exercises based upon the topics, (d) describe the teaching of the topics in an eighth grade class at Wisconsin High School, and (e) review the class reaction to the principles, definitions, and topics.

The principles and definitions selected for use in eighth grade arithmetic are consistent with the Fundamental Laws of Reckoning enumerated by Felix Klein in the book Elementary Mathematics, Vol. I. The statements are adapted to the language of eighth grade pupils. The topics and illustrated exercises appear in three chapters: The Basis of Numbers; An Analysis of the Fundamental Operations with Rational Numbers; and Developing the Idea of Proof.

The organized materials were taught to an eighth grade class at Wisconsin High School, the laboratory school of the University of Wisconsin. Since the class was small, no statistical study was attempted. Teacher-made tests, however, were used to analyze the achievement of the class with specific topics.

A basic assumption to the study is that mathematics instruction should be developed in relation to general principles and meaning. This assumption is related to the meaning theory of teaching arithmetic, transfer of training, and concept formation. The report on these topics results from an analysis of current literature in the fields of psychology and mathematics education.

The study illustrates likenesses, referred to as principles, in the fundamental operations of arithmetic. For example, multiplication problems such as 6 x 32, 15 x 48, 4 (x + 3), (x + 2) (x - 5), and 3 1/2 x 4 1/4 all follow the assumption common to multiplication. The organized materials include such illustrations and these are accompanied by explanations.

The observations made of this class are the judgments of the writer who also taught the topics. It is stated that the approach outlined in the chapters can be used with eighth grade pupils, so far as difficulty of the material is concerned. This approach can also be enjoyed by the pupils. The new ideas appear to challenge the better pupils and at the same time provide a means of explanation for the slower person.

The suggested materials developed from basic principles and definitions are consistent with current emphasis upon curriculum changes in the mathematics program of secondary schools. Referring to the mathematics curriculum the College Entrance Examination Board concludes that: " . . . our mathematics curriculum must emphasize general principles, ideas, and techniques which have wide application and educational value . . ." This study presents a segment of such a curriculum for an eighth grade class.

197 pages. $2.60. Mic 57-3143

A SURVEY OF PRACTICES IN STUDENT TEACHING PROGRAMS FOR PROSPECTIVE ELEMENTARY SCHOOL TEACHERS IN CATHOLIC INSTITUTIONS IN THE UNITED STATES

(Publication No. 21,042)

Sister John Marie Davis, C.C.V.I., Ed.D.
The University of Texas, 1957

Supervisor: Dr. L. D. Haskew

The major purpose of the study was to investigate practices in student teaching programs in Catholic institutions. A questionnaire was constructed to include items relative to: (1) objectives of the student teaching program, (2) organization for student teaching, (3) laboratory facilities, (4) financial and contractual arrangements, (5) bases for admission and assignment to student teaching, (6) organization of course in student teaching, (7) directed observation, (8) supervision of student teaching, and (9) evaluation of student teaching.

A pilot study was conducted to validate the questionnaire. Thirty-two persons appraised the instrument, and visits were made to nine institutions for the purpose of refining the content of the instrument.

Visits were also made to fourteen institutions to secure information on the sequence of activities engaged in by student teachers.

A further area of inquiry was related to the preparation and guidance of college lay students for teaching in Confraternity of Christian Doctrine centers. The training programs of two institutions were selected for intensive investigation. Data were secured through interviews with the directors of the college CCD units and from materials furnished the investigator.

The study was confined to those institutions which enrolled lay students, as well as religious, in their teacher education departments, and which had an organized student teaching program for prospective elementary school teachers. Ninety affiliated Catholic institutions participated in the entire study.

The major findings of the investigation included the following: (1) It was apparent that very few colleges

organized their student teaching programs around a definitive set of aims. (2) Patterns of organization for student teaching did not vary to a marked degree. Only a small percentage of institutions had a coordinating or advisory committee for making policy recommendations and evaluating the program. (3) Considerable attention was given to the development of off-campus student teaching experiences. (4) There was a tendency on the part of the institutions to make a direct payment to the cooperating teacher, which was covered by a student teaching fee in the majority of the institutions. Few institutions provided any other form of compensation for cooperating teachers. (5) Only a small percentage of the institutions made formal arrangements in the way of a written contract or agreement with the cooperating schools. (6) The institutions apparently were aware of the importance of screening candidates for student teaching. The dominant requirements followed were the attainment of a required scholastic average in all college courses and in education courses. There was a tendency to appraise the demonstrated aptitude of the candidates through a study of their cumulative records. (7) Very few of the institutions required a course in Methods of Teaching Religion. (8) The majority of the institutions included only one assignment to student teaching. Data seemed to indicate a trend toward more than one assignment. (9) The time allotted to student teaching was increasing and was moving in the direction of half-day teaching for an entire semester. (10) There appeared to be a need for a more varied program of experiences for student teaching during the student teaching period. Most of the experiences engaged in by student teachers were confined to in-school activites, with limited participation in community activities. (11) The institutions did not seem to favor a separate course in directed observation prior to student teaching. Many of the institutions included observation, participation, and/or actual teaching in courses prior to student teaching. (12) Relatively few institutions maintained records on the qualifications of cooperating teachers. (13) Regularly scheduled conferences and visits were not the general practices in the institutions. (14) Evaluation of the work of the student teacher was mainly carried on through the cooperative efforts of college and school personnel.

Recommendations were based on those in School and Community Laboratory Experiences in Teacher Education, published by American Association of Teachers Colleges, 1948. 477 pages. $6.10. Mic 57-3144

AN ANALYSIS OF SELECTED ASPECTS OF UNDERGRADUATE PROGRAMS IN TEACHER EDUCATION PROVIDED IN FLORIDA COLLEGES AND UNIVERSITIES FOR THE PREPARATION OF TEACHERS FOR THE ELEMENTARY SCHOOL

(Publication No. 22,225)

Roy E. Dwyer, Ed.D.
The University of Florida, 1957

It was the purpose of this study to investigate and analyze the status of selected aspects of undergraduate programs provided by eleven Forida colleges and universities for the preparation of elementary school teachers, and to determine major problems in the programs as seen by personnel of these institutions. Criteria pertinent to the aspects investigated, stated as Guiding Principles, were formulated. These Guiding Principles provided the bases for the drawing of implications for the improvement of undergraduate elementary teacher education programs.

Data were gathered by the following means: (1) examinations of the files in the Division of Teacher Education, Certification and Accreditation in the State Department of Education; (2) interviews with key personnel in the institutions studied; (3) examination of documents provided by the institutions; (4) the administration of a questionnaire. These data were presented in tabulation and description. Common features and diversities in the aspects investigated were highlighted, and summary statements were presented where their inclusion gave needed clarification.

Further analysis of the data was achieved through the consideration of the composites of practices to the criteria established in the Guiding Principles. These composities of practices tended more toward violation of the Guiding Principles than toward compliance with them. While specific practices varied widely from institution to institution, there was found to be a considerable body of common agreements in underlying policies.

The following statements represent the major findings of the study:

1. The exact number of students prepared in all the insititutions studied who were qualified to teach in the elementary school could not be determined. Records kept at the individual institutions did not lend themselves to the securing of these data.

2. State certification requirements seem to be the most influential single factor in curriculum construction as it relates to the preparation of elementary school teachers in the institutions studied.

3. In all of the institutions studied the internship provided the major opportunity for direct experiences with children for students preparing to teach in the elementary school. In seven of the institutions it provided the only opportunity for interaction between children and the teacher-to-be.

4. No specific training for cooperating teachers is mandatory. Four of the institutions offer a course designed to provide instruction in the supervision of interns.

5. The practice of combining preparation to teach in the elementary school with some other preparation is held in general favor.

6. The general preparation of the student preparing to teach in the elementary school was seen by key personnel who responded to the questionnaire as constituting an area of more serious problem presentation than either the professional or the specialization areas of preparation.

7. The complexity of problems involved in teacher education and the limited resources available make it difficult to design and conduct experiments which will provide sound bases for program change.

Recommendations for action were made. These were formulated on the assumption that changes in existing practices and procedures toward conformity with the Guiding Principles was desirable. Recommendations for action included the following: (1) that programs in general education be so organized that greater recognition be given the needs, interests, and problems of students and of society; (2) that the professional preparation of the prospective elementary school teacher be offered in a

designated sequence, distributed over the four years of preparation, and presented in comprehensive courses; and (3) that the minimum preparation for cooperating teachers be determined and incorporated in the Florida Statutes as an area of certification.

Recommendations for further study included the following: (1) a study to determine the objectives to be realized in the internship; and (2) a study to determine the training and qualifications necessary for cooperating teachers.

221 pages. $2.90. Mic 57-3145

STUDY OF THE PRE-SERVICE EDUCATION OF TEACHERS GRADUATED FROM THREE WISCONSIN TEACHER TRAINING INSTITUTIONS

(Publication No. 22,349)

John J. Goldgruber, Ph.D.
The University of Wisconsin, 1957

Supervisor: A. S. Barr

The investigation is a study of 24 graduates from La Crosse State College, 24 from Stevens Point State College and 28 from the School of Education of the University of Wisconsin teaching in a limited geographic area of Wisconsin. The graduates' pre-education preparation in broad areas was evaluated by means of an interview instrument. The purpose of the study is to (1) discover needs, (2) identify problems and (3) pool judgments for the improvement of teacher education programs. The interview instrument consists of 5 parts. Part I is made up of 12 broad areas usually associated with teacher education programs. The areas were broken down into specific aspects and activities commonly associated with teaching. The administrators were requested to rate the preparation of the graduates on a 3 point rating scale of 1 for poor, 2 for good, 3 for excellent and 4 if the rater had no evidence on which to rate. The graduates were rated on their "Knowledge of," "Attitude toward" and "Performance in" in the aspects and activities listed. The administrators were also elicited to respond to the following statements for each aspect and activity: "In which added training of the teacher would improve his performance," "In which the teacher has received in-service training from you," "In which the teacher would profit most if you were to expand your in-service program," and "Primarily the responsibility of the training institution." In addition the evaluators were to rate each aspect and activity in terms of value for teaching on a three point scale as follows: "little value," "valuable" and "very valuable."

Part II and V consists of questions concerning teacher education programs and problems associated with teaching. Questions in Part III and IV attempt to have the administrators evaluate the teacher placement bureaus and the follow-up services of the training institutions studied. They are minor parts of this investigation.

The author made a personal visit to the superintendents and principals employing the graduates in order to make personal contact and give directions for completing the questionnaire. As the questionnaires were returned the ratings were tabulated and means determined for each aspect and activity and area. A numerical rating of 1.00 was given to poor, 2.00 for good and 3.00 for excellent. A 2.00 was given an arbitrary rating of satisfactory. The closer the means were to 3.00 the more satisfactory the preparation and the closer the means were to 1.00 the less satisfactory. The ratings of the graduates' preparation, responses to the statements and ratings of the aspects and activities in terms of value for teaching appear on Tables. The responses to questions were either grouped under common ideas or meanings, or selected responses appear in the main body of the thesis.

The data gathered suggests that for the most part the administrators rated the graduates' preparation in "Knowledge of" and "Attitude toward" satisfactory. In general the ratings for performance were less satisfactory. The means for the areas of General Education and Professional Relatings are generally above the means of other areas.

The broad area of School Organization, Practices and Support rated the least satisfactory of the areas. The graduates received a less than satisfactory rating in knowledge and performance in the field of Guidance. However, graduates rated satisfactory in their attitude.

Some of the most frequently mentioned problems of the graduates are:

1. The inability to understand the importance of good public relations with pupils, teachers, administrators and the public.
2. The adjustment of the graduate with an urban background to a small rural community.
3. The inability to recognize and provide for individual differences.
4. The graduates' difficulty to adjust to the status of a teacher.
5. The difficulty of the graduate to bridge the gap between theory and practice.

To a question regarding teachers of teachers the administrators' comments suggest that college instructors are not acquainted with the problems of the classroom, teachers and administrators and therefore suggest that they get acquainted with the schools especially those in which their graduates are placed.

The responses to a question on student teaching centers on an extended period of time in a block semester in a public school with a cross section of social, economic and ability student population under a competent classroom supervisor.

488 pages. $6.20. Mic 57-3146

A STUDY OF BEGINNING ELEMENTARY TEACHER EDUCATION NEEDS AND PROBLEMS IN THE STATES OF WASHINGTON AND OREGON

(Publication No. 22,173)

Jasper Harry Johnson, Ed.D.
University of Washington, 1957

Supervisor: Dr. Homer Boroughs, Jr.

The purpose of the study was to discover the needs and problems of the beginning elementary teachers as these related to professional preparation, present

experiences and further training. To achieve this purpose the following was accomplished:

1. An analysis of the professional trends of teacher training programs in the states of Washington and Oregon.
2. An evaluation of the preparation, experiences and needs of the beginning teacher.
3. An examination of the various environmental factors confronting teachers.
4. A comparative evaluation of proficiencies gained from teacher training programs in the states of Washington and Oregon.

Questionnaires were sent to 627 county and public school superintendents, elementary principals and elementary teachers of the state of Washington, and 227 beginning elementary teachers in Oregon. Of the 528 questionnaires returned 444 (58.9 per cent) were used for the study. This represents a sampling of more than 15 per cent of the 2890 beginning elementary teachers and administrators in Washington and of the beginning elementary teachers of Oregon who met the criteria for participation in the study.

The following is a selected listing of the conclusions:

1. Few school superintendents (18 per cent) had an in-service training program for new teachers.
2. Superintendents reported that special plans have been prepared for teacher-community participation in 66.7 per cent of first-class and 56.1 per cent of second-class school districts.
3. The majority of administrators (67.0 per cent) reported that teachers today were better prepared than those of ten years ago.
4. Most principals (78.9 per cent) stated that teachers have sufficient knowledge of subject content for the position now held.
5. Eighty (88.9 per cent) principals were satisfied with the professional growth of beginning elementary teachers.
6. Fifty-eight (64.4 per cent) principals stated that beginning teachers appreciate the help of a qualified experienced teacher from within the same building.
7. Sixty-three (48.1 per cent) Washington and sixty-five (49.6 per cent) Oregon teachers desired more student teaching.
8. Washington (57.3 per cent) and Oregon (50.4 per cent) teachers generally favored a one day institute as a means of meeting first year needs.
9. Visits to homes helped teachers (63.4 per cent) to understand Washington's students. One-third (33.6 per cent) did not visit the homes.
10. Most teachers in Washington (95.4 per cent) planned to return to college for additional training, and eighty-one (61.8 per cent) expected to earn another degree.
11. One hundred twenty-five (95.5 per cent) Washington teachers enjoyed teaching.

225 pages. $2.95. Mic 57-3147

A STUDY OF THE VALUES OF A SCHOOL VISITATION PROGRAM FOR FRESHMAN ART STUDENTS AT BALL STATE TEACHERS COLLEGE

(Publication No. 19,276)

Mary Roberta Law, Ed.D.
Indiana University, 1956

Chairman: William H. Fox

Statement of the problem. The purpose of this study was to determine the value of a classroom observational type of laboratory experience in helping freshman art students to improve in general knowledge, interest, and attitudes toward the teaching-learning process. In order to discover the values of such a program it was necessary to select experiences that would be most beneficial to freshmen art students at Ball State Teachers College. The remaining aspects of the problem pertained to: (1) discovering attitudes, general knowledge and interest of students previous to their participation in the experiment, (2) conducting the classroom visitation program, (3) determining changes in attitudes, general knowledge and interest of the students following the visitation program, and (4) drawing conclusions from the findings.

Procedure. The problem and proposed solution were presented to the Ball State Teachers College Art Department Faculty for suggestions and approval. Arrangements were made with the Muncie City Schools for college students to visit eight classrooms. After preliminary arrangements were made, 60 freshman art students were selected to participate in the experiment.

The Minnesota Teacher Attitude Inventory was selected to measure the attitudes of the subjects. A second inventory was constructed by the investigator to measure general knowledge and opinions about teaching not covered in the above inventory. A jury of eight educational experts aided the investigator in selecting pertinent items for the inventory and in determining a key of responses for the statements that were included.

The two inventories were administered to the 60 subjects, and the group was divided into two equated groups by case for case matching on scores received on the inventories. One group became the experimental group and the other became the control group. While the experimental group was engaging in the classroom visitation program and attending regular college classes, the control group was not visiting classrooms but attending regular college classes. Both groups were enrolled in Art 102.1 Design, which had no relationship to the experiment, except that the total group was together in this class and available for testing and other contacts needed for the experiment.

The experiment group visited eight classrooms which included kindergarten, second, fourth, fifth, sixth, seventh, ninth, and eleventh grades. Outstanding teachers were selected so that students would have the opportunity to see the best available examples of teaching-learning situations. Schools represented in the study included a variety of socio-economic groups as well as a variety of facilities.

During the five weeks of classroom visitation the investigator held group conferences with the experimental

group. Each student participated in two group conferences during the visitation period to discuss observations.

Following the completion of the observations both the experimental and control groups were re-tested using the same inventories that were given at the beginning of the experiment.

The results were analyzed by comparing scores received on the inventories by the experimental and control groups at the beginning and at the end of the experiment. Student's Method for Comparing Matched Groups was used in order to determine the "t" value of gains made by the experimental group over the control group as a result of the visitation program.

Findings and conclusions. When scores made by the experimental and control groups at the beginning and at the end of the experiment were compared, results indicated a significant gain at the .01 level of probability by the experimental group. The conclusion was made by the investigator that the type of professional laboratory experience used in the experiment made significant improvement in attitudes, general knowledge, and opinions of freshman art students toward teaching.

This study offered further evidence that freshman students desired more first-hand experiences in teaching situations. The group conference technique for purposes of guidance was employed and found to be useful as a method of counseling. 178 pages. $2.35. Mic 57-3148

EDUCATION, THEORY AND PRACTICE

PHILOSOPHICAL IMPLICATIONS OF PARENT-CHILD RELATIONSHIP

(Publication No. 22,165)

Clifford Donald Foster, Ph.D.
University of Washington, 1957

Supervisor: Dr. Curtis T. Williams

The purposes of the study, "Philosophical Implications of Parent-Child Relationship," were to (1) develop criteria for evaluation of parent-child relationship based upon the following educational philosophies: idealism, naturalism, realism, and pragmatism; (2) apply the criteria developed in the study to examples of current thought on parent-child relationship in order to determine the influence of the four educational philosophies; (3) outline the basic philosophical differences reflected in current thought on parent-child relationship; and (4) outline the basic aspects of philosophical agreement reflected in current thought on parent-child relationship.

The criteria for the identification of idealistic, naturalistic, realistic, and pragmatic parent-child relationship were extracted from the writings of philosophers who addressed themselves primarily to the philosophy of education.

The criteria were applied to examples of current thought on parent-child relationship in order to ascertain the influence of the four educational philosophies in current literature on parent-child relationship. Each example was analyzed with regard to (1) the source of value, (2) the nature of the child, (3) the role of the parent, (4) the parent-child relationship, and (5) the instruments of knowledge.

The large majority of the examples which were analyzed in the study revealed that the authors made prescriptions for parent-child relationship but did not state their philosophical point of view. The development of the criteria in the study made it possible to identify the philosophical aspects of parent-child relationship which were reflected in these prescriptions.

The analysis revealed that the authors were not in agreement concerning the source of value in parent-child relationship. In the examples which reflected idealism, values were believed to be absolute and eternal. In the realistic examples, values were described as those interests or preferences which were found to be common in society. In the naturalistic examples, the locale of value was the child; consequently, value existed whenever the child's emotional and physical needs were met. In the pragmatic examples, value was defined as the successful solution of a problem encountered in parent-child relationship; consequently, value was held to be a constantly changing condition.

In the final analysis the examples of current thought on parent-child relationship were influenced by the following principles: in the idealistic examples the parent-child relationship was parent-centered; in the naturalistic examples, the relationship was child-centered; in the realistic examples, the relationship was society-centered; and in the pragmatic examples, the relationship was experience-centered.

The combination of two or more philosophical points of view in a single source was reflected in several of the examples of current thought on parent-child relationship. The most commonly accepted aspects involved: (1) The significance of understanding the child's needs. In no case was there a prescription for treating the child as a miniature adult. (2) Importance was attached to the child's ability to adjust to the regulations and rules of society. The degree of social adjustment which was deemed adequate depended upon the particular philosophical point of view. (3) The role of the parent was commonly described with regard to the parent's setting an example of the desired behavior. (4) A sense of "oughtness" prevailed with regard to the nature of the parent-child relationship; consequently, parent-child relationship was defined in terms of a desired goal. (5) The instruments of knowledge which were utilized to obtain information concerning parent-child relationship were common to the various philosophical points of view. However, in the examples of realistic parent-child relationship, great stress was placed upon the statistical verification of knowledge.
276 pages. $3.55. Mic 57-3149

THE CONTENT AND THE INTERRELATIONS OF THE SOCIAL SCIENCES IN GENERAL EDUCATION PROGRAMS IN SELECTED COLLEGES IN THE SOUTH

(Publication No. 22,455)

George Harlan Hallman, Ph.D.
University of Minnesota, 1957

Adviser: H. T. Morse

The purpose of this study was to determine the differences between general education and non-general education courses in treating a selected topic in social science among colleges accredited by the Southern Association of Colleges and Secondary Schools.

To study the content of the courses, selected on the basis of catalog and other descriptive information, a single sample was chosen--the topic the greatest number of general education courses dealt with. The most common topic, considered by fourteen of the eighteen general education courses, was the "Industrial Revolution." The causes and the effects of the Industrial Revolution were selected for analysis.

Each of the assignments on the topic by the selected general education courses was canvassed, and lists were made of each of the causes and each of the effects each assignment mentioned. For purposes of comparison ten widely used freshman or sophomore non-general education social science textbooks which dealt with the selected topic were also canvassed and similar lists were made. A third basis of comparison was ten more specialized works, which dealt with the topic, for which similar lists were made. The lists revealed that the general education works mentioned more causes and more effects than did the non-general education or the specialized works.

The lists of causes and effects were then classified as to social science disciplines according to the three types of works compared. A percentage break-down of these classifications showed that the general education works mentioned sociological causes proportionately a little less, political causes considerably more, economic causes a little less, and geographic causes considerably less than they mentioned causes of all types. Non-general education works tended to emphasize geographic and sociological causes and to under-emphasize political causes. Specialized works tended to under-emphasize political causes but tended to mention sociological, geographic, and economic causes in about the same proportion as they mentioned all causes.

The general education works tended to under-emphasize sociological effects of the Industrial Revolution but to emphasize economic effects and to give a considerable amount of emphasis to the socio-economic effects. Non-general education works emphasized sociological effects but under-emphasized economic effects and greatly under-emphasized socio-economic effects. Specialized works tended to mention the effects classified under the various disciplines in nearly the same proportions as they mentioned all effects.

The nature of this study made many subjective judgments necessary. A different method of analysis or an analysis by another worker might, therefore, have yielded results which would have differed from those reported in the study. The significance of this study of content, however, is in suggesting a method of approach useful in analyzing the substantive differences between general education and non-general education courses. This study does show that the general education works analyzed covered the sample topic more broadly (but not necessarily more deeply) than did the non-general education or the specialized works. An examination of the list of the effects of the Industrial Revolution showed, also, that the general education courses were more concerned with the contemporary aspects of the sample topic than were the other two types. This concern is in keeping with a widely recognized principle that general education courses must attempt to meet the needs of their students as laymen or citizens in understanding contemporary affairs.

301 pages. $3.90. Mic 57-3150

THE CONSTRUCTION AND EVALUATION OF OBJECTIVE TESTS OF ORAL LANGUAGE SKILLS

(Publication No. 22,120)

Douglas Francis MacDonald, Ed.D.
Boston University School of Education, 1957

Statement of the Problem

The purpose of this study was to construct tests which would measure unaided oral recall after hearing a story, unaided oral recall after silent reading of a story, general information recall from common experiences, and imaginative oral elaboration based on story completion and picture completion.

The pupils participating in the oral testing situation were 200 boys and girls in grades four, five, and six in a suburban school.

The plan of the tests involved individual pupil testing, using the tape recorder for keeping the responses for scoring and evaluation.

Oral-Language Testing Procedure

The steps in the testing procedure were these:

(1) The pupil listened to four stories; his recall was recorded on tape after each.

(2) The pupil read silently another four stories; his recall was recorded after each.

(3) The pupil was asked a series of questions based on common experiences. These responses were recorded.

(4) In attempting to measure imaginative oral elaboration, the pupil was asked to read an introductory paragraph, and then continue the story; then a picture was shown the pupil, and he was asked to tell what might be its story.

The stories used were constructed on the basis of pupils' interests.

The scoring of the pupils' responses was done by listening to the tape playback, and marking beside appropriate items on the checklist.

Findings of the Oral-Language Testing

(1) The estimated reliabilities of the two forms of the test were .87 and .85. The reliability of the

scoring technique, computed by comparing original and recheck scores, is indicated by a correlation coefficient of .97.

(2) A slight, but consistent, difference existed in favor of recall-after-silent-reading mean scores in comparison with recall-after-hearing mean scores in grades five and six. In grade four, there was no noticeable difference.

(3) Analysis of the subtest scores shows a similarity between the scores of grades five and six, but a significant difference between these and the grade-four scores.

(4) The total oral-language-test scores show correlations of .32 to .58 with Stanford Achievement Test scores.

(5) Analysis of the total recall scores indicates a consistent tendency toward a decrease in the per cent of number of ideas recalled as the stories increased in length.

(6) Boys scored significantly higher in unaided oral recall than did the girls.

(7) Girls scored significantly higher in oral elaboration after picture stimulus than did the boys.

(8) Oral elaboration after picture stimulus presented more ideas than after introductory paragraphs.

(9) The estimated reliabilities of the recall tests with the tape recorder (87 and 85) may be considered as showing what might be a consistent and promising technique of measurement.

(10) The method of scoring the number of pupils' responses in the oral tests by using checklists and tape playback is highly objective, as indicated by a coefficient of correlation of the original scores with the recheck scores of .97.

The method of evaluating pupils' responses by use of the tape recorder and checklists with tape playback appears to be a technique that might be of value in many testing situations. 243 pages. $3.15. Mic 57-3151

A STUDY OF THE ELEMENTARY MUSIC CURRICULA IN THE ELEMENTARY SCHOOLS IN DISTRICT III OF THE STATE OF IDAHO

(Publication No. 20,204)

Gene Charles Wisler, Ed.D.
University of Oregon, 1957

Adviser: Robert E. Nye

The purpose of this study was to analyze data on existing music curricula in the elementary schools of District III of Idaho and to present recommendations for improvement of current music curricula and practices.

Through the distribution of questionnaires and the conducting of personal interviews with principals, classroom teachers, and music personnel, opinions were gathered in five major areas related to the problem: (1) the aims and objectives of elementary school music, (2) the elementary school music curriculum, (3) the roles in music of the elementary school staff, (4) the educational preparation of the staff, and (5) the materials and equipment essential to elementary school music. These opinions were projected against criteria formulated from publications of the Music Educators National Conference and from writings of authorities in the fields of elementary education and music education.

These data were collected in a manner designed to give equal representation to 50 per cent of the elementary schools on each grade level (grades 1 through 6). Bias of selection was guarded against by the use of a table of random numbers to select schools and persons from whom information would be sought. There was a 91.4 per cent return of data from those persons selected for the sample; 55.4 per cent of this return resulted from personal interviews.

Conclusions

1. The philosophy of music in education as revealed by the respondents indicate only partial awareness of a music program as prescribed by current curriculum philosophy.
2. The philosophy of music in education, as revealed by the elementary school personnel of the City Area and the Outlying Area, is approximately identical.
3. Approximately sixty percent of the classroom teachers contacted consider music as a subject on an equal basis with other subjects.
4. While the enjoyment of music is basic to musical growth, this aspect of music teaching is over-emphasized, and the experiences in appreciation and in the acquisition of musical skills are under-emphasized.
5. Present classroom music programs are largely limited to rote singing and listening activities.
6. Classroom teachers who possess more college training and/or have taken in-service training in music abilities and tend to provide richer and more varied ensemble are absent in the great majority of schools.
7. Opportunities for children in the intermediate grades to take part in any type of special vocal ensemble are absent in the great majority of schools.
8. Opportunities in instrumental music are being offered to a small majority of the children in the intermediate grades.
9. The concept of music in education which conceives of music not only as a subject but also as a means of enrichment of the curriculum has gained little acceptance in these schools.
10. There is common agreement that the classroom teacher with the assistance of the music consultant is basically responsible for the music program.
11. Music personnel are too heavily burdened with teaching duties to provide sufficient time in the classroom to meet MENC standards and to give aid to classroom teachers.

12. The average educational preparation of the elementary school staff is below acceptable professional standards.
13. In the majority of classrooms contacted no supplementary materials are being used or are available in music.

A listing that the recommendations made by the writer based upon the findings of this study is too extensive to be included in this abstract. In general suggestions are presented for the organization of music personnel to administer on the state, district, county, and city levels more adequate music programs. Further suggestions are offered for the evaluation of present programs; the responsibilities of principals, classroom teachers, and various music personnel; the part to be played by institutions of higher learning in offering in-service training; and the accreditation standards of teachers.

264 pages. $3.40. Mic 57-3152

ENGINEERING, GENERAL

THE DESIGN AND INITIAL EVALUATION OF A FORCE PLATFORM FOR MEASURING HUMAN WORK

(Publication No. 22,082)

James H. Greene, Ph.D.
State University of Iowa, 1957

Chairman: Professor J. Wayne Deegan

The Industrial Engineer has relied primarily on time as a basis of measurement in evaluating work and has given little attention to actual work or physiological cost. The ultimate purpose of the research described in this dissertation is to determine whether a force-sensitive platform as used by Lauru and others can be used to measure actual work and physiological cost to give the Industrial Engineer a new scientific tool.

The Force Platform is a supported structure upon which a worker sits or stands while engaged in a physical activity while the platform senses and records forces exerted in each of the three planes.

In Part I of the dissertation an original platform design is presented with a proof of the mechanics, a description of the construction and associated recording equipment, and the testing procedure. The design differs from previous designs of similar platforms in the way the forces are uncoupled and detected.

Part II is an initial analysis and evaluation of the Force Platform as a measuring instrument. Two combinations of measurements, the force-frequency product and the force-time integral, are studied in relation to the actual work and physiological cost expended for four subjects operating a foot-lever ergometer at four levels of frequency and four levels of load. The actual work in foot-pounds was obtained from the foot-ergometer which was designed to simulate foot controls of industrial machines. Physiological cost was obtained in terms of calories and increase in pulse rate. A brief description of the gasometer and Beckman oxygen analyzer and how they were used to obtain the calorie cost by the integral method is given. A modified conventional cardioscope was used for pulse counting.

In addition to the empirical analysis, a dynamic analysis of the platform in use is presented. It is shown that the usefulness of the platform depends upon the distance value being added to the platform measurement of force.

For the experimental situation where the distance is held constant, the Force Platform value of force-frequency showed a reasonably high correlation with both work and calorie cost per unit of time. There is some indication that if the distance of the effective force is included, the actual work/time could be obtained directly and the calorie cost/time could be predicted, but with a lower degree of certainty.

The platform data which included the integral of the force-time curve detected work changes for individuals but the correlations could not be grouped. This can be explained by the direct relationship between the time and distance inherent in the experimental procedure rather than the effectiveness of force-time as a predictor of actual work.

No correlation existed between platform factors and an increase in pulse rate. Wide variations in pulse rate were probably caused by factors other than an increase in physiological cost.

The future of the Force Platform will depend upon its being combined with some auxiliary attachment which will contribute the dimension of distance to the dimension of force, as given by the platform, to produce a value of work.

231 pages. $3.00. Mic 57-3153

A QUANTITATIVE APPROACH TO EQUIPMENT LOCATION IN INTERMITTENT MANUFACTURING

(Publication No. 22,304)

Robert J. Wimmert, Ph.D.
Purdue University, 1957

Major Professor: H. T. Amrine

The first portion of this paper reviews and critically analyzes the criteria for plant layout proposed by the contemporary plant layout authorities. It then develops an in-process material movement cost criterion based upon the time required to move material from one process area to another within an intermittent manufacturing plant. The applicability of the proposed criterion is discussed and analyzed by the use of a symbolic representation of the major variables encountered in the process system. Included in the criterion is a factor called "impedients" which takes into account the impeding effect that the general physical surroundings have upon the material handling equipment. Localized conditions such as aisle turns, cross aisles, etc., which restrict the operating speed of the material handling equipment are considered in the factor "obstructions." An equivalent distance concept is introduced in order to have a common denominator between the straight line portion of the movement and the obstructions. The various types of obstructions are expressed in terms of the number of feet the material handling equipment would travel in a straight line movement during the time necessary to pass through the obstruction. The effect that the product move load has upon the operational efficiency of the material handling equipment is considered by an equivalent load concept. Loads which do not adversely affect the operation of the material handling equipment are considered standard loads. Loads which adversely affect the equipment operation are expressed as a number of equivalent standard loads. The numerical value of the equivalent standard loads is proportional to the extent

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of the load influence on the material handling equipment.

The second portion of this paper is interested in the objective methodologies available for the minimization of the criterion developed in part one. The traditional operations research techniques which might be applicable are considered and the reasons why they are inappropriate for the plant layout problem are indicated. A new criterion minimizing technique, based upon the properties of a special type of square matrix, is developed and proven. The row headings of the special matrix are the number of equivalent loads passing between the different pairs of machines and the column headings are the equivalent distances between different pairs of available locations. The cell entries are the product of their respective equivalent loads and equivalent distances. The determination of the optimal equipment arrangement is accomplished by systematically discarding the various nonoptimal equipment-location combinations. The properties of the special matrix permit the elimination of blocks of combinations at each step; hence, problems involving large numbers of machines and locations can be solved with relative ease. In addition, the proposed minimizing technique can be modified to take into consideration the grouping of similar equipment, the separation of incompatible processes, the placement of machines within specified locations, and the location of storage and service facilities. As a summary, each step in the solving of an actual industrial, 15 machine group-15 location, problem is outlined and discussed. The solution of this illustrative problem indicates a possible equipment rearrangement which would result in a 12% savings in the inter-work area material movement cost.

187 pages. $2.45. Mic 57-3154

ENGINEERING, AERONAUTICAL

THERMAL STRESSES, THERMAL BUCKLING AND VIBRATIONS OF SOLID WINGS

(Publication No. 22,661)

Josef Singer, D. Ae. E.
Polytechnic Institute of Brooklyn, 1957

Adviser: Dr. N. J. Hoff

The thermal buckling of wings with all edges free is analysed by the Rayleigh-Ritz Method. First wings of large aspect ratios are treated and the end effects are neglected. A double power series is assumed for the deflection function, and through the use of successively increasing numbers of terms the predominance of the simple torsional distortion is established. The analysis is carried out for a number of typical temperature distributions for a plate of constant thickness and for a solid wing of parabolic cross section. Non-dimensional coordinates and suitable orthogonal polynomials are used to facilitate the calculations. The predominance of the simple torsional distortion is clearly demonstrated for the plate of constant thickness. For the wing of parabolic cross-section the simple torsional distortion is shown to yield a fair approximation to the lowest critical temperature.

The investigation of the effect of the ends of the plate involves a solution of the thermal stress problem of a thin rectangular plate of finite side ratio. Two approximate solutions of this problem, obtained by the variational method for a plate of constant thickness, are described and compared. The two methods are extended to rectangular plates of chordwise varying thickness, and their application is discussed.

The buckling analysis is now repeated for a plate of constant thickness and small aspect ratio, and the validity of the previous conclusion about the predominance of the simple torsional distortion is verified.

Having been established as a good approximation, the torsional analysis is now modified to include also short wings. It is shown that the effects of chordwise normal stresses and shear stresses cancel out, and that the critical temperature of a finite wing can be obtained from that of an infinite wing by multiplication by an "end effect factor." For a plate of constant thickness, this factor is approximately the same for all typical temperature distributions. The end effect is found to be more than 10% for aspect ratios below 6.

The alleviating effect of the change in thermal stress due to large deflections on the torsional rigidity is described and analysed.

Finally, the torsional vibrations of a long thin solid wing subjected to aerodynamic heating are calculated by the Rayleigh-Ritz Method. The effect of the change in thermal stresses due to finite amplitudes is included. To simplify the solution of the resulting non-linear equations, a single-term deflection function is assumed, and the assumption is justified. An explicit expression is obtained for the relative frequency for any given temperature distribution and initial amplitude of vibration. A typical example is worked out to indicate the significance of the alleviating effect of the finite amplitude.

The assumption of harmonic vibrations used in the Rayleigh-Ritz approach is examined by the more accurate analysis yielding elliptic time functions, and is shown to be satisfactory for practical purposes.

145 pages. $2.00. Mic 57-3155

ENGINEERING, CHEMICAL

CHLORINATION OF OLIVINE EMPLOYING FLUIDIZED SOLIDS TECHNIQUES

(Publication No. 22,158)

Kermit Bernard Bengtson, Ph.D.
University of Washington, 1957

Chlorination of olivine according to the chemical reaction

$$Mg_2SiO_{4(c)} + 2CO + 2Cl_2 \rightarrow 2MgCl_{2(g)} + 2CO_2 + SiO_{2(c)}$$

had previously been investigated on a small scale using a fixed bed. Results of this chlorination, carried out at a temperature high enough to volatilize all magnesium chloride formed, had been found very encouraging with respect to reaction rate, calculated heat liberation, and chlorination of silica. The object of the present work was to study the

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application of fluidized solids techniques to this chlorination in order to find out whether or not these techniques might make the chlorination practical on a large scale. It was also expected that additional information of general interest would be gained with respect to the application of fluidized solids techniques to high temperature processes in general.

A fused quartz chlorinator, a graphite resistance furnace for heating the chlorinator, a device for making gas stream chlorine analysis by means of ultraviolet absorption photometry, and other auxiliary equipment were constructed. A total of 57 experimental runs were made at approximately one atmosphere pressure between 900° and 1320°C. The maximum MgO-FeO chlorination attained was 73% at a silica chlorination of 7.6%. The maximum average MgO-FeO chlorination rate measured was .035 grams chlorine per minute per gram silica in the fluid bed. This maximum was measured at about 30% MgO-FeO conversion. The maximum possible initial chlorination rate is extremely large, although such a rate could not be measured. Every detectable trace of chlorine was removed from gas containing up to 18 mole per cent chlorine while the gas was moving at a superficial velocity of 0.5 feet per second through a two inch deep bed of olivine at 1250°C.

It was found that the presence of a thin layer of silica chlorination residue on the surface of the olivine particles caused them to soften and stick together at a relatively low temperature, resulting in loss of bed fluidity. Initial chlorination with gas of low chlorine content at a low temperature until the particles became coated with a silica film of suitable thickness prevented this to a certain extent. Olivine of a certain particle size range could thereafter be chlorinated at higher temperatures without loss of bed fluidity.

A major factor in olivine chlorination is found to be chlorination time. A rapid recrystallization of the silica residue on the surface of the particles occurs after a certain period of chlorination time. This recrystallization renders the unreacted particle surface only difficultly accessible to the chlorinating gas, with the result that the MgO-FeO chlorination rate becomes very small and the net chlorination of silica begins.

A pilot plant based in part on the experimental work is proposed. Heat balances, observed experimental chlorination rates, and other evidence indicate that olivine of proper particle size range could be chlorinated on a large scale through employment of fluidized solids techniques. A two stage, countercurrent process is proposed in which the heat of reaction and other enthalpy would be sufficient to maintain equipment at the necessary high temperature.

140 pages. $2.00. Mic 57-3156

CENTRIFUGAL FILTRATION THROUGH BEDS OF SMALL SPHERES

(Publication No. 21,982)

J. Byron Bingeman, Ph.D.
Louisiana State University, 1957

Supervisor: Professor Jesse Coates

It was desired to investigate the flow of incompressible fluids through beds of small spheres of mixed size in centrifugal filters. Accordingly, centrifugal filtration data were taken in the viscous flow region on beds of styrene-divinyl benzene spheres in four mesh sizes: 50/100, 100/200, 200/400, 400/-. The beds were formed in two horizontal laboratory centrifugal filters which were five inches and eleven inches in diameter and capable of a maximum rotational speed of 4000 rpm. In the large basket a maximum force of 2500 Gees could be developed, or a maximum pressure drop of 93 psi at the greatest liquid level used. Cakes were approximately 0.1 to 0.2 inch thick in the small basket and approximately 0.5 inch in the large basket. They were prepared by dropping dry solids into a pool of liquid in the rotating basket. Water was the filtrate in all cases but one in which a glycerol solution was used.

The resistance of the filter medium was obtained by running a blank on the filter medium over the range of speeds to be used in a subsequent filtration run. It was then possible to calculate as a function of the pressure drop through the bed the filtration rate which would occur through the solids only.

Experimental conditions were such that the flow rate was in the viscous region and the cakes were non-compressible. Under such conditions the d'Arcy equation for the flow of incompressible media through unconsolidated beds would be expected to apply with a single value of the permeability. This was found to be the case. However, experimental values of the resistance coefficient and the permeability were found to differ greatly from those which would be calculated theoretically on the basis of the average measured particle size, excluding fines. This discrepancy and some difficulty in obtaining reproducibility were attributed to fines which were present or possibly to gas blocking of the cake.

The Burak-Storrow and Grace applications of the d'Arcy equation were found to correlate the data. A dimensionless form of the same equation was applied in the correlation of the centrifugal filtration data reported in this work and data taken from the literature.

71 pages. $2.00. Mic 57-3157

RATES OF GROWTH OF SINGLE CRYSTALS OF ANHYDROUS AND MONOHYDRATE CITRIC ACID

(Publication No. 22,652)

Raymond M. Cartier, D.Ch.E.
Polytechnic Institute of Brooklyn, 1957

Adviser: Paul F. Bruins

This investigation was undertaken to study the factors which contribute most to the behavior of the crystal growth

process. The factors which have received little attention in the past and which appear very important in predicting growth rates are those which related to properties and structure of the crystalline material.

Heretofore, studies have been made on the growth rates of a number of crystalline systems wherein the simultaneous influence of both solution and crystalline properties prevailed. The data from these studies are difficult to relate to crystalline properties because of the interfering influence of solution conditions. One might compare the above situation to a study of the overall mass transfer coefficient of a transfer process as opposed to a more fundamental study of the limiting phase mass transfer coefficient.

The lack of an adequate experimental technique is primarily responsible for the difficulty in securing the desired growth rate data. The influence of solution conditions on the growth process is expressed in the form of a diffusional resistance. The influence of the crystalline properties is due to a particle integration mechanism which involves the collision of a solute particle with the crystal face, and subsequent migration and orientation on the surface where eventually it attaches itself permanently into the crystal lattice.

The influence of solution conditions as a resistance to the growth process becomes nominal when sufficient solution agitation (viz. convection current) is provided. The limiting or controlling factor in the growth process is, therefore, the particle integration mechanism. This mechanism is dependent primarily on the nature of the crystalline material, with such properties as energies of particle attachment, reticular density of crystal planes, and crystal class, dominating the process.

It is the purpose of this thesis to study the particle integration mechanism with respect to crystalline properties and to provide the necessary experimental technique and apparatus enabling the collection of growth rate data which reflects the influence of this mechanism.

An experimental technique has been developed which permits continuous microscopic observation and measurement of a growing crystal obviating its removal from the flowing solution environment. In addition, the experimental equipment is provided with means for creating sufficiently high solution to crystal velocities, to reduce substantially all the resistance offered by diffusion to the crystal growth process.

It is apparent from experimental growth rate data on both anhydrous and monohydrate citric acid, and from photographic evidence, that screw dislocations are a part of the physical growth mechanism for citric acid monohydrate.

The Amelinckx dynamic growth model for a homopolar crystal has been modified to render it suitable for graphical solution. The modification is, $\overline{G} = \overline{K}\, e^{\rho/\sigma(C_1 - C_s)} - \overline{K}$ where K is the particle integration factor. This factor is a function of crystalline properties as well as temperature.

$$\overline{K} = \frac{\alpha \sqrt{kT/2\pi m}}{4} - \frac{m}{\tau_0 S_{hkl}}\, e^{-(Tr)_{avg}\overline{S}/6.023\times10^{23}}$$

This generalized correlation is convenient to apply to growth rate data and provides the general rule that (growth rate plus particle integration factor) versus supersaturation at constant temperature, will plot as a straight line on semi-logarithmic paper.

The correlation applied to the (111) face of citric acid monohydrate is of the form,

$$\overline{G} = (4.1409T^{1/2} - 69.244)10^{-6}(e^{10^{-1.7305-0.00531T}(C_1 - C_s)} - 1)$$

328 pages. $4.20. Mic 57-3158

RATES OF ADSORPTION IN FIXED BEDS

(Publication No. 22,653)

Homi Sorabji Daruvala, D.Ch.E.
Polytechnic Institute of Brooklyn, 1957

Adviser: J. C. Chu

The purpose of this investigation is to evaluate the fundamental rate constants of adsorption operations. To this end, it is necessary to obtain laboratory data in the form of effluent concentration leaving the adsorption bed at frequent intervals of time. It can then be evaluated in the light of the fundamentals of diffusional operations. This required the development of a new mathematical approach to the problem based on solid diffusion through a spherical particle with a linear isotherm.

The experimental method requires air of constant flow rate and water vapor content. It is passed through a bed of solid adsorbent held at the same constant temperature as the air. The effluent concentration leaving the bed is measured by determining the dew point at definite intervals of time. The adsorbents used were two types of silica gel, one prepared by Socony Vacuum Company and the other prepared by Davison Chemical Company. The adsorption bed was initially saturated so as to operate over the linear region of the isotherm. The range of variables in the experimental investigation are as follows:

1. Mass Velocity of the air, 90 to 935 $\frac{\text{lbs}}{\text{hr.ft}^2}$
2. Particle diameter, 0.0128 to 0.00226 ft.
3. Temperature of adsorption, 76°F to 160°F.
4. Bed height, 0.3 to 2.38 ft.
5. Initial saturation of the bed, 0 to 21%, $\frac{\text{lbs water vapor}}{\text{lb dry adsorbent}}$
6. Inlet composition relative to initial saturation of bed, 1.83×10^{-3} to 15.5×10^{-3} $\frac{\text{lbs water vapor}}{\text{lb dry air}}$

The following correlations have been developed:

1. $\text{Hosa}_v = 5.5\left[\frac{D_pG}{\mu(1-\epsilon)}\right]^{0.58}$ . . . . . (82)
2. $J_D = 0.32\left[\frac{D_pG}{\mu(1-\epsilon)}\right]^{-0.48}$ . . . . . (84)
3. $\frac{k_s}{\alpha} = 1.8\, a_m$ . . . . . (85)
4. $W_s = 15.6\ e - 7.5\,\phi^{0.25}$ . . . . . (86)

Where: Hosa_v is the overall height of a transfer unit.

$\frac{D_pG}{\mu(1-\epsilon)}$ is the modified Reynold's number

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J_D is the mass transfer factor.

W_s is the final fractional saturation of the bed, and

ϕ is the diffusivity function $\left[\frac{Dvt}{D_p^2 \alpha 0.5}\right]$

D_v is the diffusivity, t is time, D_p is par- diameter and α is the slope of the isotherm.

The results of this investigation can be applied to the design of adsorption units such as gas purification and separation units, solvent recovery units and hypersorbers. It can also be used to control and evaluate the performance of these units. 218 pages. $2.85. Mic 57-3159

FACTORS AFFECTING THE YIELDS AND PROPERTIES OF THE PRODUCTS OF THE LOW-TEMPERATURE CARBONIZATION OF PENN-LEE COALS FROM SOUTHWESTERN VIRGINIA

(Publication No. 22,030)

John Lillis Disney, Jr., Ph.D.
Virginia Polytechnic Institute, 1957

The purpose of this investigation was to study the factors affecting the low-temperature carbonization of seam number one, Penn-Lee coal from southwestern Virginia, by determining the effect of pretreatment of the charge, temperature of the retorting gas, and time of retorting on the yields and properties of the products of carbonization.

After an examination of the literature pertinent to the investigation, a pilot-scale carbonization unit was constructed. The construction of the unit consisted partly of the modification of an existing fluidization unit. Various auxiliary apparatus were also added to the modified unit for more satisfactory operation.

A series of bench-scale tests were performed to study the effect of pretreatment conditions on the free-swelling index, the weight loss, and the volatile matter in Penn-Lee coal. Time and temperature had a significant effect upon the free-swelling index. Temperature of pretreatment had a significant effect on the weight loss during pretreatment. Time and the time by temperature effect were found to be significant with regard to the volatile matter remaining in the coal after pretreatment. Also, the decomposition point of Penn-Lee coal was found to lie between 427 and 454°C (800 and 850°F).

Twelve pilot-scale tests were performed to study the effect of carbonizing conditions on the products of carbonization. The pretreatment time had a significant effect upon the dry tar yield, the tar viscosity, the tar specific gravity, and the twenty per cent tar distillation temperature. The time of carbonization had a significant effect upon the gas yield.

None of the variables studied showed a significant effect within the range studied, upon the volatile matter in the char product, the bulk density of the char, or the calorific value of the char. 240 pages. $3.10. Mic 57-3160

A STUDY OF MUTUAL AND SELF-DIFFUSION COEFFICIENTS IN NON-IDEAL BINARY LIQUID MIXTURES

(Publication No. 22,169)

Alexander Paul Hardt, Ph.D.
University of Washington, 1957

Previous work on self-diffusion in the systems methanol-benzene and ethanol-benzene was extended to include temperature as an additional variable. The study includes new self-diffusion data for the systems chloroform-acetone and ethanol-carbon tetrachloride, as well as mutual diffusivities for the systems methanol-benzene, ethanol-benzene and chloroform-acetone. Furthermore, new data on the viscosities and densities of the systems ethanol-benzene and chloroform-acetone as a function of temperature and composition have been added.

These data were used to calculate heats of activation for self-diffusion, mutual diffusion and viscous flow which were employed in a critical evaluation of existing theories pertaining to the prediction of mutual and self-diffusion coefficients. No constant differences between the heat of activation were found such as are required by the Eyring theory, and the failure of conventional empirical methods for the prediction of diffusivities was traced to this fact.

The self-diffusivities were determined by means of a capillary cell technique using liquids labeled with carbon-14. The liquid samples were counted with a Geiger Mueller end window tube using a counting cell of new design. Data were reported with an average precision of 5%, better agreement having been found with published data on self-diffusivities of pure liquids. Mutual diffusivities were determined with an accuracy of 1% by means of a Mach-Zehnder interferometer. Viscosities were measured with an Ostwald pipette with an estimated accuracy of 2%.

Mach-Zehnder interferograms were analyzed to determine the diffusion mechanism of alcohol-hydrocarbon systems. It was found that the associated component exists under continuous association and that the number of mers is normally distributed with respect to distance. Diffusion of alcohol aggregates of an average degree of association was postulated. The size and diffusivity of the average mer was calculated from the knowledge of a single association constant obtainable from infrared spectroscopy data and the assumption of a spherical molecule. More recent work, however, indicates that a more exact treatment of molecular association should involve the use of two or more association constants.

Finally, using the concept of intrinsic diffusivity, a semi-empirical method was developed by which mutual diffusivities may be related to self-diffusivities without activity corrections. This has been accomplished by the assumption that the relationship between self and mutual diffusivities is not the same for the associated and for the unassociated components. The experimental self-diffusivities of the associated component are converted to intrinsic diffusivities by viscosity corrections and an empirical shape factor, while the self-diffusivities of the unassociated component are assumed to equal the intrinsic diffusivities. The average agreement between the experimental and the calculated diffusivities is approximately 10% for all systems studied except at very low alcohol concentrations when the disagreement is larger. By this

method both the order of magnitude and the location of the minimum in mutual diffusivity curves are correctly predicted. 135 pages. $2.00. Mic 57-3161

STATIC PRESSURE GRADIENTS IN TURBULENT JET MIXING

(Publication No. 22,278)

David Radford Miller, Ph.D.
Purdue University, 1957

Major Professor: Edward W. Comings

This investigation included an experimental study of the classical two-dimensional free air jet (single jet) and the flow compounded of two identical two-dimensional air jets issuing from parallel slit apertures in a common wall (dual jet). In each case the flow was incompressible as well as turbulent, and attention was focused on those flow variables entering into the force-momentum relations of the Reynolds equations. Particular emphasis is placed on the roles of the mean static pressure distributions, in view of their past neglect.

In addition to static pressure, measurements of the mean velocity, normal turbulent stress (the latter two by a hot-wire anemometer), total pressure and flow direction are presented. The measurements cover the entire region of turbulent flow from the nozzles to 40 slit widths (20 in.) downstream. The results are interpreted in the light of the unsimplified equations of fluid motion and existing free jet theory.

A negative static pressure field, including the entire region of turbulence, is created in the single jet. Its magnitude and directional derivatives at any point are closely related to those of the normal turbulent stress, indicating that the static pressure deficiency in the turbulent region of the flow is a manifestation of the phenomenon of turbulence. The principle of Reynolds number similarity is shown to hold. Self-preservation of the lateral mean velocity profile occurs about 7 slit widths downstream from the nozzle, after which the profile is very close to a Gaussian error curve. Static pressure and turbulent stress profiles approach but do not reach self-preservation 40 slit widths downstream from the nozzle. Total pressure readings (when interpreted as the kinetic energy of the mean flow) are subject to turbulence and static pressure errors, approximately in accordance with prediction.

In the dual jet, static pressure gradients are responsible for the convergence of the emerging jets and for the creation of a free stagnation point and two stationary vortices, which supply the initial entrainment air to the inner sides of the emerging jets. Mean velocity, stream function and static pressure contour maps of the converging region are presented. The development of the turbulent motion in the core of either of the converging jets is somewhat assymetrical about the jet's central streamline but otherwise quite similar to the development of the turbulence in the single jet. The similarity disappears, of course, when the two streams merge. After the jets merge into a single jet, a period of transition follows before the flow is fully developed. When fully developed, however, the flow is practically identical to the corresponding single jet when comparisons are based on the dimensionless flow variables at equal distances from the nozzles.
208 pages. $2.70. Mic 57-3162

A STUDY OF PLATE EFFICIENCIES OF DISTILLATION SYSTEMS WITH PARTICULAR REFERENCE TO MASS TRANSFER RESISTANCE IN THE LIQUID PHASE

(Publication No. 21,901)

Charles Andrews Plank, Ph.D.
North Carolina State College, 1957

Supervisor: E. M. Schoenborn

Distillation studies were made on the binary systems acetone-water, methyl ethyl ketone-water and methanol-toluene in a 5 plate bubble cap tower with 7-1/2 by 17-1/2 inch rectangular trays. Data for the acetone-water system, where the gas-phase resistance is high, have been correlated with ammonia absorption data. All of the systems have concentration regions wherein the liquid-phase resistance represents at least 50% of the total resistance. Numerical values of the liquid-phase resistance were obtained from overall resistance data using the gas-phase correlation and the concepts of the Whitman "two-film" theory. Accuracy of the methods employed and internal consistency of the data are shown by comparison of the two aqueous ketone systems.

The liquid-phase resistance data for the distillation systems are shown to correlate with carbon dioxide desorption data; the number of liquid-phase transfer units being expressed as a function of the liquid-phase Schmidt group, ratio of liquid to gas holdup on the tray and the residence time of the liquid on the tray. This liquid-phase correlation is shown to predict the efficiency of an essentially pure liquid-phase resistance distillation system far more accurately than other existing correlations.

Data concerning hydraulic characteristics, such as the degree of liquid mixing on the tray, height of froth and clear liquid heights on the operating tray are presented, and their importance in relation to mass transfer is shown and discussed. 149 pages. $2.00. Mic 57-3163

THE ANALYSIS OF TWO-DIMENSIONAL LAMINAR FLOW UTILIZING A DOUBLY REFRACTING LIQUID

(Publication No. 22,669)

John William Prados, Ph.D.
The University of Tennessee, 1957

Major Professor: F. N. Peebles

The optical characteristic exhibited by certain liquids known as flow double refraction offers attractive features in the analysis of two-dimensional laminar flow situations, especially those in which measuring probes are undesirable. Such liquids become anisotropic to the passage of light when

set in motion; and when they are viewed in polarized light while flowing through a transparent channel, visible interference patterns are observed. These patterns may be related to the magnitude and direction of the shearing stresses set up by two-dimensional laminar flow, and from suitable calibration under known flow conditions they may be used to determine the stress distribution in an unknown flow situation.

Attempts made by previous investigators to apply this technique to the analysis of flow have not yielded promising results. The doubly refracting test liquids used have been either very unstable or extremely viscous. Also, results have been analyzed under the assumption that doubly refracting properties could be correlated directly in terms of streamline directions and velocity gradients, rather than in terms of the direction and magnitude of the shearing stresses in the liquid. This assumption appears questionable in the light of certain experimental facts noted in this investigation, except for flow cases involving parallel streamlines.

The objectives of the present investigation were twofold: (a) the development of methods for predicting streamline directions and velocity gradients from the stress distributions obtained from double refraction measurements, thus avoiding the necessity of any direct correlation between the gradients themselves and the doubly refracting properties, and (b) the experimental application of these methods to two-dimensional laminar flow situations, and the checking of results by independent means whenever possible.

The desired analytical methods were developed, and experimental studies were carried out for the following situations: (a) flow between parallel plates, (b) converging and diverging flow between flat, non-parallel plates, and (c) flow about a cylindrical obstacle in a bounded channel. In case (a), streamlines were determined by the parallel channel walls. In case (b), streamlines were assumed to be straight lines emanating radially from the point of intersection of the non-parallel walls. In case (c), streamlines were determined from information on stress directions obtained from the flow double refraction patterns. The doubly refracting liquids employed were aqueous solutions of a commercial dye, milling yellow, which remain stable over a period of approximately two weeks, and which have viscosities in the neighborhood of twenty centipoises. They show Newtonian behavior under shearing stresses less than 5 dynes per square centimeter, the range interest of this investigation. Correlation of doubly refracting properties with stress was obtained by observation of the known flow situation in the annular space between fixed and rotating concentric cylinders. The flow test channel was made of Plexiglas and was of rectangular cross section with a high aspect ratio (ratio of width to depth) in order to approximate two-dimensional flow. The channel was five inches wide and contained 1-inch and 1/2-inch deep sections joined by a converging section.

A velocity profile obtained from double refraction measurements for plane parallel flow was checked with that predicted by the theoretical formula for flow between plane parallel plates, and all points agreed within $\pm$3.0 per cent. Velocity profiles in plane parallel, converging, and diverging flow were integrated to yield total discharges which were compared with experimentally measured discharges for each case. Agreement was within a maximum deviation of $\pm$10.0 per cent and a mean square deviation of 4.2 per cent for all plane parallel flow cases, and within a maximum deviation of $\pm$13.5 per cent and a mean square deviation of 7.8 per cent for all converging and diverging flow cases. The experimental discharge was required in the analysis of flow about a cylindrical obstacle, and could not be used for comparison. However, the viscous drag coefficient for the cylinder was calculated from flow double refraction measurements and compared with theoretical and experimental literature values. Agreement was found within 2.0 per cent with the theoretical value and within 10.5 per cent with the experimental value. The range of flow rates covered was from 20 to 200 cu.cm./sec., and corresponded to Reynolds numbers from approximately 1 to 10.

In conclusion, it appears that the technique offers attractive possibilities for the analysis of complex two-dimensional laminar flow situations, and with certain experimental refinements, should be capable of even better results than those reported above.

178 pages. $2.35. Mic 57-3164

AN ANALYSIS OF BURNOUT IN TWO-PHASE, LIQUID-VAPOR FLOW

(Publication No. 22,500)

Robert G. Vanderwater, Ph.D.
University of Minnesota, 1957

Major Adviser: H. S. Isbin

A study has been made of burnout in boiling heat transfer. This phenomenon occurs as a result of a transition in the heat transfer mechanism causing the heated surface to overheat and "burn out."

A survey of the literature concerning burnout in the following categories is presented: pool boiling burnout, local boiling burnout in forced convection (no net generation of vapor), and two-phase burnout in forced convection (i.e., with net generation of vapor).

An analysis is made of the latter category and a model is proposed to predict conditions under which burnout will occur. The model is based upon a spray-annular distribution of the flow. A portion of the liquid is assumed to flow along the tube wall in an annular film. The remainder is assumed to be dispersed as droplets in the vapor core occupying the center of the tube. Burnout is assumed to occur at the point in the tube at which the annular liquid film disappears. Thus an equation is developed to predict the liquid distribution and hence burnout. The model is used to correlate data on burnout for vertical-upward flow of steam-water mixtures in round and rectangular channels.

128 pages. $2.00. Mic 57-3165

ENGINEERING, CIVIL

ENERGY LOSSES IN BENDS OF LARGE CURVATURE RATIOS

(Publication No. 22,338)

Abdel Fattah El Kouh, Ph.D.
The University of Wisconsin, 1957

Supervisors: Professors J. R. Villemonte and A. T. Lenz

Most of the work published on bend losses in the past was concerned with turbulent flow through bends, and a conclusion was reached that the bend coefficient is slightly affected by the Reynolds' Number. Very little information about bend losses for streamline flow is available. Most of this published information for the streamline flow region is for bends of curvature ratios, d/D, equal or less than 0.066. Information concerning the losses in the streamline region for bends of larger curvature ratios which are of practical importance in hydraulic circuit design is lacking.

A bend with large curvature ratio, d/D, is defined in this thesis as one where the pipe diameter, d, in terms of the diameter D of the circle of pipe curvature is large.

Tests on nine one-inch constant circular cross-section bends with various radii of curvature and various angles of deflection, and one 1/2-inch 90-degree single-miter bend were carried out with Heavy Paraffin Oil and Fuel Oil No. 2. The tests were run in the streamline flow region as well as in the turbulent flow region up to a Reynolds' Number of about 6000. The test results were then plotted using logarithmic scales in the form of an effective friction factor against the Reynolds' Number. This effective friction factor is defined by the Darcy-Weisbach equation $H = f' \frac{L}{d} \frac{\overline{w}^2}{2g}$, where: H = head loss across the test section, L/d = the length of the test section in diameters, at least 100 diameters, f' = effective friction factor for the test section and $\overline{w}$ = mean velocity of flow in the test section.

It was found that the critical Reynolds' Number at which the flow changes from laminar to turbulent conditions is about 2100. This critical Reynolds' Number is about the same as that suggested by the different experimenters for straight pipe flow. The test results in the streamline flow region were then analysed on the basis of a dimensionless parameter, $N_R(d/D)^{\frac{1}{2}}$, derived from the Navier-Stokes equations. The ratios of the effective friction factor to the straight pipe friction factor at the same Reynolds' Number were plotted as ordinates and the corresponding dimensionless parameters as abscissae. Although this parameter was derived using the simplifying assumption that the curvature ratio is so small that terms of an order higher than that of $(d/D)^{1.0}$ in the equations of motion could be neglected, it appeared that this parameter is the dynamic similarity criterion for the problem under consideration.

An empirical formula was obtained for the ratio of the friction factors using a test length of 117 diameters as a reference test section.

The individual test points fell within $\pm$ 5% from a single continuous curve whose equation was:

$$(f'/f_s)_{117} = 4.5 \times 10^{-4} N_R (d/D)^{\frac{1}{2}} + 0.953$$

This formula is applicable for butt welded bends having a curvature ratio of about the order used in the experiments, that is close to either 1/2 or 1/3 which are widely used in hydraulic circuits. From these tests it seems that within the accuracy of the instruments used, the ratio of the friction factors is independent of the angle of deflection.

The bend coefficient K in $H_L = K \overline{w}^2/2g$ expresses the head loss due to the bend in terms of the "mean velocity" head. Using the above equation for the ratio of the friction factors a formula for the bend coefficient was obtained which is:

$$K = 3.37(d/D)^{\frac{1}{2}} - 352/N_R$$

Both these formulas are applicable in the laminar flow region below $N_R = 2100$ and when $N_R(d/D)^{\frac{1}{2}} \geqslant 105$.

From the experiments and from the above formulas it appears that the bend coefficient follows a trend quite different from that followed in turbulent flow; that is, the bend coefficient increases along with the Reynolds' Number in the streamline flow region while in turbulent flow it decreases with the increase in the Reynolds' Number.

131 pages. $2.00. Mic 57-3166

LIMIT ANALYSIS OF SIMPLY SUPPORTED CIRCULAR SHELL ROOFS UNDER UNIFORM RADIAL LOADING

(Publication No. 22,656)

Morris N. Fialkow, Ph.D.
Polytechnic Institute of Brooklyn, 1957

Adviser: Professor Philip G. Hodge, Jr.,

Plastic collapse of a partial circle cylindrical shell simply supported at each end with the longitudinal edges free is investigated for the case of uniform radial loading. The constant thickness shell is approximated by a sandwich type shell of equal plastic strength considering each stress resultant individually. For equilibrium only the membrane stress resultants, the transverse bending moment and the radial shear are considered with all other stress resultants taken equal to zero. A linear approximation to the Mises yield condition for plane stress is utilized and expressed in terms of stress resultants. The associated plastic Flow Rule is developed.

The principles of Limit Analysis applicable to a plastic-rigid structure are utilized to develop bounds for the collapse pressure parameter, $\overline{P}$. Several statically admissible stress fields yielding effective lower bounds are developed. The stress resultant fields are analyzed for location of extrema of stress resultant combinations and yield criteria are enforced to give equations for the lower bound of $\overline{P}$. Several kinematically admissible velocity fields with associated equations for the upper bound on $\overline{P}$ are also developed. The equations for bounds are used to compute values of upper and lower bounds for a wide range in shell shape parameters. For the range considered, the deviation between the mean of the bounds and either bound varies between 2 and 25 per cent. Results are tabulated and drawn as a series of graphs.

The results obtained indicate the general relationship between $\overline{P}$ and the shape parameters involving the shell thickness, radius, length, and subtended angle. It is shown that the collapse behavior of long shells is similar to the

collapse of beams, that short shells tend to collapse locally along the edges, and that the behavior of intermediate length shells represents a transition between the long and short shell. 109 pages. $2.00. Mic 57-3167

THE LOAD-CARRYING CHARACTERISTICS OF A BITUMINOUS CONCRETE RESURFACING MIXTURE

(Publication No. 21,298)

John Francis McLaughlin, Ph.D.
Purdue University, 1957

Major Professor: W. H. Goetz

This report presents the results of a laboratory study which was carried out in order to investigate certain of the load-carrying characteristics of a bituminous-concrete overlay.

The study was subdivided into two parts. In the first part all tests were performed on specimens molded in the laboratory; in the second part, pavement cores for laboratory tests were obtained from a section of pavement which had been resurfaced with bituminous concrete in the summer of 1950.

The bituminous-concrete mixture which was used for the laboratory-compacted specimens was first characterized by performing several series of conventional laboratory tests. Included were the Marshall test, ASTM Compression test, triaxial test, and the Hveem Stabilometer and Cohesiometer tests. Further tests were performed on laboratory-compacted specimens in order to estimate the load-carrying capacity of a relatively thin layer of bituminous concrete when loaded over an area that was small with respect to the size of the specimen and, hence, to estimate the "confinement" which may be present in a thin bituminous-concrete overlay. In addition, the relationship between the strength of a bituminous concrete mixture and the variables of rate of deformation and temperature was investigated by means of compression tests on specimens two inches thick and four inches in diameter compacted by two different methods.

A similar investigation of the strength- rate- temperature relationship was made on pavement-core samples of two-, three-, and four-inch thicknesses. Pavement cores were also subjected to two types of repeated load tests (called rapid-cycle and slow-cycle tests) in order to study the effect of number of load repetitions on cumulative permanent deformation of the specimen. In addition to specimen thickness, the variables of temperature and stress intensity were studied in these tests.

It was found that for the materials, mixtures, and methods used in this study:

1. The load-carrying capacity of a bituminous-concrete mixture, compacted into a relatively thin layer and loaded at a constant rate of deformation over a small portion of the total surface with a plate which is relatively large with respect to the layer thickness, appears to be several times greater than the unconfined compressive strength of the mixture for the same temperature and rate of deformation.

2. The "confinement" in a relatively thin pavement layer of bituminous concrete, loaded over an area that is large with respect to layer thickness, appears to be considerably in excess of the unconfined compressive strength of the mixture.

3. The relationship between the strength of bituminous concrete and the variables of temperature and rate of deformation is of the form

$$x_o = A^{Bx_1^{(Cx_2 + D)}}$$

where x_o = maximum compressive strength
x_1 = rate of deformation
x_2 = temperature, and
A, B, C, D = constants

4. With respect to the repeated load tests, it appears as if the relationship between cumulative permanent deformation and number of load repetitions for the rapid-cycle test results, in the region before failure of the specimen is of the form

$$y = kx^{\frac{1}{n}}$$

where y = cumulative permanent deformation
x = number of load repetitions, and
k and n = constants.

In addition, the rapid-cycle repeated load test appeared to be a promising method for the evaluation of the plastic nature and endurance properties of bituminous-aggregate mixtures. 178 pages. $2.35. Mic 57-3168

ENGINEERING, ELECTRICAL

THE TAUTOCHRONE AND BRACHISTOCHRONE FOR NONLINEAR SERVOMECHANISMS

(Publication No. 22,249)

Magnus Victor Braunagel, Ph.D.
Purdue University, 1957

Major Professor: Dr. Elias M. Sabbagh

The application of nonlinear techniques to the design of automatic controls is very promising. The recent advancements in the scientific fields have resulted in automatic control performance requirements that are difficult if not impossible to be fulfilled by the linear technique of design. One such requirement is for an automatic control that has a step input response which is independent of the magnitude of the initial step error. This is to say that the automatic control shall be able to correct a variable magnitude of error in the same period of time without exhibiting any overtravel or overshoot. The problem is to derive the analytical expressions for the variable coefficients of the differential equation so that the desired response is obtained.

The cycloid curve possesses several interesting characteristics. It is the curve on which a particle will, in the absence of friction, roll or slide to the lowest point on the curve in the same interval of time, independent of the initial starting point. It is also the curve on which a particle,

acted upon by the force of gravity, will descend to a lower level in the shortest period of time. The behavior of a particle on the cycloid curve thus possesses the characteristics that are desired of the error quantity in an automatic control.

The coefficients of the differential equation for an automatic control are derived in terms of the displacement, velocity, and acceleration of the particle on the cycloid curve. The coefficients are nonlinear and can be expressed in terms of either the error quantity or in terms of time. When the parameters of the automatic control possess certain relationships to each other, the expressions for the nonlinear coefficients assume a form that can be realized with control components that are now in existence. The equations simplify so that they can be readily used in selecting physical components.

260 pages. $3.35. Mic 57-3169

SAMPLED-DATA REPRESENTATION OF NONLINEAR SYSTEMS

(Publication No. 22,251)

Richard Kuo-wei Cheng, Ph.D.
Purdue University, 1957

Major Professor: G. R. Cooper

The object of this research is to see if certain useful analysis and synthesis techniques may be derived from representing nonlinear systems in their discrete or sampled-data forms. The emphasis, moreover, is placed on nonlinear feedback control systems the importance of which has been steadily rising in recent years.

The works of Singleton[1] and Whitford[2] provide the starting point of this investigation. Singleton's generalization of the mean-square-error criterion as applied to the nonlinear problem and Whitford's subsequent synthesis procedure for a practically realizable simulation of such an idealized optimum transducer have indicated a fresh approach to the design of feedback control systems.

The synthesis procedure of Whitford's equivalent system of the Singleton transducer is extended here to include the cases of unavoidable linear and nonlinear elements inside the feedback loop. The results obtained include a useful recursion formula suitable for the time-domain synthesis of linear as well as nonlinear networks whose input-output relations may be approximated in sampled-data form.

The stability of nonlinear sampled-data systems of this type is examined next. It is discovered that the theory of linear difference equations provides at least a rudimentary understanding with respect to the asymptotic behavior of such systems. The nonlinear terms merely place additional constraints on the initial conditions. The complexity of this latter problem increases directly with the order of the system, which, in effect, is equivalent to the inherent memory capacity of the forward-gain element. The cases of systems of the first and the second orders are studied in some detail. A graphical technique analogous to the phase-plane method used for nonlinear differential equations is found to be of some assistance here.

Finally, the sampled-data representation technique is applied to a class of practical feedback systems with certain inherent nonlinearities. A systematic numerical analysis procedure, basically digital in character, is obtained for such systems. The principle of time-domain convolution is used advantageously for the linear elements present. This, in addition to an iteration method for dealing with the nonlinear element as well as the peculiar consequences arising from the closed-loop configuration, enables us to evaluate the responses of such systems to arbitrary forcing functions. 145 pages. $2.00. Mic 57-3170

1. Singleton, H. E., Theory of Nonlinear Transducers, Technical Report No. 160, Research Laboratory of Electronics, M.I.T., August 12, 1950.

2. Whitford, R. K., An Approach to the Synthesis of Nonlinear Servomechanisms, Ph.D., Thesis, Purdue University, 1955.

AN INVESTIGATION OF THE INFORMATION CONTENT OF ELECTROENCEPHALOGRAMS

(Publication No. 22,090)

Edwin Carl Lowenberg, Ph.D.
State University of Iowa, 1957

Chairman: Professor L. A. Ware

Introduction

Electroencephalograms (abbreviated EEG) are recorded variations of potential between points on the scalp as a function of time. EEG signals are clinically recorded with high gain amplifiers driving oscillographic ink writing pens. The EEG records are studied clinically by visual observation of the EEG record and by simple peak to peak voltage measurements and by counting the number of axis crossings in certain intervals of time.

The purpose of this investigation was to study the problem of quantitative analysis of the EEG signals and to develop electronic equipment to make the desired measurements. The results of this investigation can be integrated into a long time program of research.

Electronic Equipment

The EEG signal needs to be recorded in such a way that the electrical signal may be repeated as desired. A frequency modulator (and de-modulator) unit was built which uses the EEG signal to modulate a carrier so that a frequency spectrum is generated which is within the range of a conventional tape recorder. A Magnecord PT-6 magnetic tape recorder was used with this FM unit to record samples of EEG signals from the clinical laboratory. A special isolation amplifier was built and mounted in the clinical laboratory so that one of the EEG signals being recorded on the Grass Electroencephalograph was available in the electronics laboratory.

The results of the analysis of the basic phase-shift oscillator circuit were incorporated into the design of very selective low frequency filters using this circuit. One of the developments involved a method of adjustment so that the Q remains constant over the entire frequency range of the filter which includes the entire EEG frequency range.

The selectivity can be adjusted to a Q of several thousand. Special power supplies were used for the filter in order to achieve maximum stability.

A special average-reading type of a.c. voltmeter was designed to measure the steady-state filter output. Provision was made to connect an external d.c. recorder to this meter so that the average magnitude could be recorded on the same paper as the EEG signal. This meter could also be used to measure the average magnitude of the original EEG signal.

Experimental Procedure

Intervals of EEG signals recorded on magnetic tape may be made into continuous tape loops. A repetitive function is generated by operating the continuous tape loop in a special adapter for the tape recorder. The magnitude of each frequency component in the frequency spectrum can be measured using the adjustable filter and the special low frequency voltmeter.

Measurements involving the average magnitude of the frequency spectrum of the EEG signals may also be made with the same equipment. Using only one special meter and one filter, it is necessary to rewind the tape and repeat the signal for each filter setting.

Conclusions

Intervals of recorded EEG signals can be analyzed by measuring the magnitude of each frequency component in the discrete spectrum resulting from continuous repetition of the chosen interval.

A study of many randomly chosen samples of EEG signals from EEG patients was made to determine the general functional characteristics of EEG signals. Measurements made on these EEG signals indicate that the frequency spectrum is continuous with no discrete lines. In general, these EEG signals resemble band-limited noise. A noise source was used to synthesize signals which resemble real EEG signals so closely that electroencephalographers cannot distinguish the real from the synthesized signals. These studies indicate that these samples of real EEG signals are not signals with superimposed noise but are all noise.

Future efforts should include careful study of all types of abnormal EEG signals, but EEG signals recorded during epileptic seizures should be of special interest.

76 pages. $2.00. Mic 57-3171

INVERSE PROBABILITY IN TRACK-WHILE-SCAN RADAR SYSTEMS

(Publication No. 22,293)

Raymond Erwin Runyan, Ph.D.
Purdue University, 1957

Major Professor: George R. Cooper

The concept of a track-while-scan radar system appears promising as a possible approach to the problem of automatic air traffic control and for use in military applications. The function of a track-while-scan radar system is to maintain a continuous surveillance of surrounding air space for the purpose of detecting any targets which might enter this space, and to track such targets using the intermittent range, azimuth, and elevation data received for a short period of time during each complete scan of the radar antenna.

This investigation considers the automatic track-while-scan radar problem from the viewpoint of extracting the information as to target position contained in the output of the radar receiver, and using this information to make decisions as to target presence and to predict future target position to accomplish the tracking function. The information available as to target position contained in the receiver output is extracted in the form of an a posteriori probability distribution of target position which is obtained by the method of inverse probability using available a priori information as to target position in conjunction with the output of the radar receiver.

A pulsed search radar is considered consisting of narrow band linear r-f and i-f sections followed by an ideal linear envelope detector. Only information contained in the pulse amplitudes, as represented by the detector output, is considered, any phase information being assumed lost. The targets are assumed to return a signal whose amplitude is Rayleigh distributed and pulse to pulse independence is assumed on the basis that the pulse repetition frequency of the system is low compared to the frequency of target signal fluctuations. White Gaussian noise is added to the signal in the first stages of the receiver.

Expressions are obtained for the a posteriori probability density functions for target range, azimuth, and elevation in terms of a priori information as to target position, a set of pulses at the receiver output, and related system parameters. The a priori information used is generally the probability distribution for predicted target position developed on the previous scan.

The decision as to target presence is made by a Neyman-Pearson test, the decision criteria being that the range a posteriori distribution reach a level of probability which is determined on the basis of a required probability of detection and probability of false alarm.

The scan to scan a posteriori probability distributions of target position are used to predict future target position, the prediction being based on straight-line, constant velocity extrapolation in each dimension of present target position. The resulting probability distributions for predicted target position are then used to position electronic gates so that the volume of air space examined on the next scan of the radar antenna will enclose the predicted target position. The probability distributions for predicted target position may also be used to give an indication of the probability of missing the target on the next scan of the radar antenna when narrow gate settings are used in an attempt to improve system resolution.

It is determined that a track-while-scan system developed to make maximum use of the information content of the received signals, as is attempted by the application of the method of inverse probability, has theoretical possibility, the practical limitations residing for the most part in the computational facilities required to process the data in order to produce the desired a posteriori probability density functions, and to determine the predicted target position from scan to scan.

103 pages. $2.00. Mic 57-3172

AN INVESTIGATION OF RADIO WAVE PROPAGATION THROUGH A CYLINDRICAL IONIZED LAYER

(Publication No. 22,294)

Edward William Rupp, Jr., Ph.D.
Purdue University, 1957

Major Professor: G. R. Cooper

The purpose of this investigation is to determine the effects of a cylindrical ionized layer upon the phase and amplitude of a radio wave passing through it. The initial analysis is of a layer which is time invariant and whose electron density is a function of the radial coordinate only. Formulae are derived for the electric field intensity of the energy scattered by the free electrons. The components in phase and in quadrature with the incident wave are determined. Two types of electric field polarization are considered. Polarization perpendicular to the axis of the cylinder results in a smaller amplitude of scattered signal in quadrature with the incident wave than does polarization parallel to the axis. Energy obliquely incident upon the ionization produces less scattered signal than that arriving at normal incidence.

Subsequently, consideration is given to the effects of random variations in the electron density due to turbulence. Probability density functions for the phase and amplitude of the total received signal are derived for a point antenna and for an array of point antennas. This is made possible by certain assumptions for the statistics of the turbulence.

107 pages. $2.00. Mic 57-3173

ENGINEERING, METALLURGY

A CALORIMETRIC INVESTIGATION OF ZIRCONIUM, TITANIUM, AND ZIRCONIUM ALLOYS FROM 60 TO 960° C.

(Publication No. 22,670)

James L. Scott, Ph.D.
The University of Tennessee, 1957

Major Professor: E. E. Stansbury

The favorable nuclear properties of zirconium make it a very attractive construction material for nuclear reactors. Full benefit of the material, however, can only be gained by the addition of alloys which increase the high-temperature strength. Consequently, a fundamental knowledge of the alloying behavior of zirconium is desirable. A better insight to this behavior may be secured by studying the similarities and differences between alloys of zirconium, titanium, and hafnium since these elements appear to be quite similar in the metallic state.

One approach to the study of the alloying behavior of a metal is the determination of the changes of the thermodynamic functions with the addition of a given solute. For such a determination, a knowledge of the specific heats and heats of transformation of the alloys of interest is required. Consequently, the measurement of the specific heats and heats of transformation of a series of alloys of zirconium as well as titanium was undertaken.

The pure metals and alloys studied were iodide zirconium, iodide titanium, and alloys of zirconium with 0.881 and 5.37 weight per cent silver, 7.77 weight per cent indium, 17.5 weight per cent niobium, 34.4 weight per cent titanium, and 300 parts per million of hydrogen. Measurements were made over the temperature range of 60° to 960° C through the use of a high-temperature-adiabatic calorimeter. The results are presented graphically in the text.

The conclusions which were drawn from this investigation are:

1. The specific heat of beta zirconium is lower than that of alpha at the transformation temperature of 870 ± 2° C. Analogously the specific heat of beta titanium is lower than that of alpha at the transformation temperature of 883 ± 2° C. For a zirconium - 17.5 weight per cent niobium alloy, which should correspond quite well to pure zirconium, the specific heat of the beta phase has the constant value of 0.069 ± 0.002 calories/gram-° C from room temperature to 800° C. Within the limits of error the addition of 0.746 atomic per cent of silver or 6.27 atomic per cent of indium does not affect the specific heat of either the alpha or beta phase over their ranges of stability above room temperature. An alloy of higher silver content (4.58 atomic per cent) does have a slightly higher specific heat in the alpha region, presumably because of the higher specific heat of the intermetallic compound Zr_2Ag.

2. The heat of transformation of zirconium is 993 ± 25 calories per gram atom at 870° C, and the heat of transformation of titanium is 978 ± 25 calories per gram atom at 883° C. Within the limits of experimental error the heats of transformation of zirconium and titanium would have the same value if the transformations occurred at the same temperature. Although the transformation from the alpha to the beta phase in a 0.746 atomic per cent silver alloy occurs over the temperature range 830-865° C, the heat of transformation at an arbitrary intermediate temperature is the same as the value zirconium would have if it transformed at the same temperature within the limits of error. This is also true for an alloy of zirconium with 6.27 atomic per cent of indium, which transforms over the range of 910-940° C. The temperature of the eutectoid transformation in the zirconium silver system is 825 ± 2° C and the heat of transformation of the eutectoid (3.73 atomic per cent silver) is 1240 ± 25 calories per gram atom.

3. The changes in the thermodynamic functions ΔH_o^x and

$$\int_o^T dT \int_o^T \Delta C^x d \ln T$$

are quite small, so that the precision of the calorimeter used was not sufficient to permit their evaluation.

4. The heat due to the solution of ZrH_2 in alpha zirconium may be detected calorimetrically even when the hydrogen content is as low as 28.5 ppm. The heat of solution is approximately 11,000 calories per mole of hydrogen.

5. There exists a metastable transition in a zirconium-17.5 weight per cent niobium alloy below 520° C which has

decided effects on the specific heat curves and on the hardness but cannot be identified by metallographic or x-ray investigations. This transformation is tentatively called the omega transition. A second metastable phase which occurs at lower temperature can be identified metallographically and with x-rays, but has little effect on the hardness or the specific heat.

6. An alloy containing 50 atomic per cent titanium with zirconium shows the expected specific heat behavior in the alpha phase, but the specific heat of the beta phase is definitely abnormal. The beta specific heat decreases linearly from 650° C to 800° C. This effect may be interpreted as a disordering of the beta phase. The transformation occurred over the range 550-640° C on heating and 558.5-560.5° C during cooling. The heat of transformation of 740 ± 20 calories per gram atom at 600° C is abnormally low.

130 pages. $2.00. Mic 57-3174

ENGINEERING, SANITARY AND MUNICIPAL

A PROCEDURE FOR FINDING THE MINIMUM CHEMICAL DOSAGE FOR CLARIFICATION OF AN OIL EMULSION

(Publication No. 22,253)

James Edward Etzel, Ph.D.
Purdue University, 1957

Major Professor: Don E. Bloodgood

A survey of the published literature on disposal of oil-in-water emulsions revealed that chemical coagulation was the only method of treatment reported to be consistently successful. It is known that process control procedures for chemical coagulation are time-consuming, and the information obtained is only an approximation. It is common practice to use an excess of chemicals in order to insure proper treatment at all times. It was the purpose of this research to develop a more exact means for determining the quantity of chemical required in a shorter period of time than the present "jar testing" procedure.

Literature on the theory of coagulation disclosed that most efficient use of chemicals is obtained when coagulation is carried out at the iso-electric point.

It was deduced that if an easy means for determining the quantity of a coagulant necessary to reach the iso-electric point could be found, this information should also aid in determining the minimum quantity of chemical required for coagulation.

The physical properties of turbidity and viscosity of an emulsion had been reported to attain a minimum value at the iso-electric point. Using this information, it was found that when acid and base were used for altering the charge on colloidal oil particles, viscosity could be used to determine the iso-electric point. When ferric sulfate was used to reduce the viscosity to a minimum, the ferric hydroxide produced interfered with the viscosity measurements.

The next attempt to determine the quantity of ferric sulfate required to reach the iso-electric point involved the measurement of rate of decrease in turbidity. Results of investigations on an emulsion prepared from Superla Soluble Oil showed that the rate of decrease in turbidity could be used to determine the minimum quantity of ferric sulfate required for coagulation. With an emulsion stabilized with triethanolamine and oleic acid, a secondary chemical reaction occurred which masked out any change in turbidity produced by the ferric sulfate.

A titrimetric procedure using acid fuchsin and methylene blue as indicator dyes was found to be the most reliable procedure for determining an iso-electric point. The basic principle involved in the procedure is attraction of unlike signs on the colloidal particles and the dye molecules, the end point occurring where the colloidal particles have zero charge and, consequently, no attractive power. In the procedure developed, a sample of emulsion was titrated with hydrochloric acid until the sample (which contained both indicators) changed from blue to red. The pH at the end point defined the iso-electric point; and the quantity of hydrochloric acid gave a measure of the amount of chemical required to reach the iso-electric point. The quantity of hydrochloric acid was then correlated with the quantity of ferric sulfate which had been found by the "jar testing" procedure to be necessary for coagulation. Results of iso-electric point titrations and "jar tests" on three emulsions were used in development of the equation $x = 21{,}900c^{-0.612}y$, where x is the quantity of ferric sulfate required for coagulation and charge neutralization, c the concentration of emulsion to be coagulated, and y the quantity of hydrochloric acid required to reach the iso-electric point. Thus, knowing the quantity of hydrochloric acid required to reach the iso-electric point pH and the concentration of an emulsion, the quantity of ferric sulfate required for coagulation can be obtained by means of the developed equation. The quantity of calcium hydroxide required is the amount necessary to adjust the pH to the iso-electric point pH value and to add any alkalinity needed for floc formation.

152 pages. $2.00. Mic 57-3175

FINE ARTS

AN HISTORICAL CATALOGUE OF ITALIAN, FRENCH, AND GERMAN ROMANESQUE ARCHITECTURE AND SCULPTURE IN THE STATE UNIVERSITY OF IOWA THREE DIMENSIONAL SLIDE COLLECTION

(Publication No. 22,072)

John Victor Blackwell, Ph.D.
State University of Iowa, 1957

Chairman: Professor Lester D. Longman

The purpose of this dissertation is to analyze the structural principles and styles of Romanesque church architecture in Italy, France, and Western Germany, using as examples the three-dimensional slide collection of the Art Department of the State University of Iowa.

A general history of each church is given in connection with the first slide of that church which, in most cases, is a view of the façade. Every slide of each church is discussed, presenting the important structural features and stylistic characteristics. A discussion of the interior of each church follows that of the exterior, and the architectural sculpture is taken up where most appropriate. In the case of controversial churches, those opinions which appear to be most accurate are given in the body of the dissertation, while divergent opinions are referred to in the footnotes.

Churches of Italy have been presented in the three general divisions of Northern Italy, Central Italy, from Rome to and including Tuscany, and Southern Italy, only by the Cathedrals of Ravello and Amalfi. In France, the usual Provincial stylistic divisions are followed; Perigord, Poitou, Provence, Auvergne, and Normandy. Only Burgundy is omitted since it is not included in the slide collection. Experimental churches are discussed separately because their unique solutions to the vaulting problem require a separate treatment. The sculpture of Moissac is also treated separately, since Langued'oc did not produce a unique school of architecture. In Germany only the churches of the Rhenish Provinces are considered, but these are the principal German churches of the Romanesque period.

The Italian churches included in the dissertation are Modena, Cathedral; Pavia, S. Michele; Parma, Cathedral; Picenza, Cathedral; Verona, S. Zeno; Verona, Cathedral; Fidenza, Cathedral; Lodi, Cathedral; Vicenza, Torre del Orologio; Bologna, Leaning Towers; Arezzo, S. Maria della Pieve; Assisi, Cathedral; Florence, Baptistry; Florence, Badia, Fiesole; Florence, San Miniato al Monte; Lucca, Church of the Misercordia; Lucca, Cathedral; Lucca, San Frediano; Lucca, San Giovanni; Lucca, San Michele; Pisa, Cathedral; Pisa, San Michele; Pisa, San Paolo a Ripa D'Arno; Pistoia, Cathedral; Pistoia, Sant' Andrea; Pistoia, San Giovanni Fuorcivitas; Prato, Cathedral; Rome, S.S. Giovanni e Paolo; Tarquinia, Santa Maria de Castello; Amalfi, Cathedral; Ravello, Cathedral.

The French churches included are Clermont-Ferrand, Notre-Dame-Du-Port; Issoire, St. Paul; Toulouse, St. Sernin; Loches, St. Ours; Le Puy, Cathedral; Caen, St. Étienne; Caen, St. Trinité; Angoulême Cathedral; Cahors Cathedral; Perigueux, Cathedral; Poitiers, Notre-Dame-La-Grande; Poitiers, Ste. Radegonde; St. Gilles; Arles, St. Trophîme, Moissac.

The German churches of the school of the Rhenish Provinces include Bonn, Münster; Coblenz, Castor-Kirche; Limburg, Cathedral; Mainz, Cathedral; Speyer, Cathedral; Worms, Cathedral.

360 pages. $4.60. Mic 57-3176

FOOD TECHNOLOGY

COTTAGE CHEESE FROM NONFAT DRY MILK

(Publication No. 22,341)

Douglas Byron Emmons, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor A. M. Swanson

In this investigation an attempt was made to develop a satisfactory method for manufacturing cottage cheese from nonfat dry milk (NDM) and to evaluate the effect of certain heat treatments used in the manufacture of NDM on curd formation, making properties, and quality of cottage cheese made from the reconstituted product.

The acid-coagulation (A-C) test was developed as a means of determining the optimum acidity for cutting the curd in the manufacture of cottage cheese. Cutting at this acidity produced significantly superior curd making properties and cheese quality than did either lower or higher cutting acidities. When the salt concentration, the casein concentration, the total solids of the skimmilk, and the amount of denatured whey proteins in heated skimmilk were varied the A-C endpoint occurred at different pH values.

The study showed that cottage cheese could be made from skimmilk heated to 175°F for 30 minutes by using the A-C test. Such heat treatments resulted in increased yields and a higher recovery of skimmilk solids; but the

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quality of curd was not acceptable for commercial cottage cheese. The use of larger than normal amounts of rennet improved the quality of the curd. Additional work on the use of increased amounts of rennet and increased total solids may lead to the development of a method which may be used commercially for the manufacture of cottage cheese from skimmilk which has been heated to temperatures higher than those for normal pasteurization. This would be of importance commercially because of increased yields and improved keeping quality of curd from skimmilk given the higher heat treatments.

The addition of calcium chloride to skimmilk for cottage cheese at levels of 0.02% and 0.05% had no effect on moisture content of the curd, curd firmness at cutting, or the quality of cottage cheese made from low- or high-heat reconstituted NDM or low- or high-heat skimmilk.

Heat treatments as high as 150°F and 160°F for 15 minutes on concentrated skimmilk of 44% and 47% total solids were detrimental to the quality of cottage cheese made from the skimmilk reconstituted to 8.8% total solids. The quality of the cottage cheese decreased as the total solids of the concentrate and the temperature of heating increased. Heat treatments of 160°F on concentrated skimmilk at 44% and 47% total solids had no effect on Hill curd tension, or the whey proteins, but rennet curd tension and rennet-calcium curd tension decreased. The heat treatments just described on concentrated skimmilk had a greater detrimental effect on the quality of cottage cheese cut at the A-C endpoint than heat treatments of unconcentrated skimmilk at 175°F for 30 minutes.

None of the tests that were run in connection with the manufacture of cottage cheese from reconstituted NDM or reconstituted concentrated skimmilk appeared to be successful in predicting the quality of cottage cheese when the A-C test was used to determine the cutting time. These tests were as follows: Hill curd tension, rennet curd tension, rennet-calcium curd tension, Harland-Ashworth test for undenatured whey proteins, a whey drainage test, and a rheological test describing the recovery of cottage cheese curd after the release of a shear stress. The rennet curd tension and rennet-calcium curd tension tests were partially successful in that they reflected the severity of the heat treatment given to the concentrated skimmilk.

229 pages. $3.00. Mic 57-3177

EFFECT OF THE USE OF FREEZE-DAMAGED FRUIT ON THE CHARACTERISTICS OF FROZEN CONCENTRATED ORANGE JUICES

(Publication No. 22,233)

George Franklin Westbrook, Jr., Ph.D.
The University of Florida, 1957

Physical and chemical characteristics were determined for 37 experimental packs of 42° Brix concentrated orange juice prepared from either normal, unfrozen fruit or from oranges showing different stages of freeze injury. Both Pineapple- and Valencia-types of oranges were processed, and heat treatment and other processing variables were included. The properties investigated were recoverable oil, ascorbic acid, pectinesterase activity, total acid, pH, pulp content, flavonoids, relative viscosity, pectic substances, gelation, clarification, and flavor.

Little relationship was found between the extent of freeze damage of the fruit and either recoverable oil, ascorbic acid, or pectinesterase activity. However, total acid decreased, and pH, Brix-acid ratio, pulp content, and flavonoids increased directly with extent of freeze injury. A high relative viscosity was characteristic of the concentrate prepared from damaged Pineapple-type oranges. Total pectin increased in all the packs prepared from freeze-damaged oranges, and large differences were noted chiefly in water-soluble and ammonium oxalate-soluble pectic substances.

Gelation and clarification were almost always more serious in the concentrates prepared from freeze-damaged Pineapple-type oranges, depending upon extent of injury; however, this did not occur with Valencia-type oranges. More heat was required to insure the stability of the concentrates made from the damaged fruit, but heat treatment of the fresh cut-back juice, which is not desirable, was not necessary when the evaporator-feed juice was heated to 195° F. The flavor of orange packs from freeze-damaged fruit was affected adversely by heat treatment. Loss of flavor and/or development of off-flavors tended to occur rapidly during storage of the concentrates prepared from freeze-damaged oranges.

The overall effect of the use of freeze-damaged fruit on the characteristics of frozen concentrated orange juice was a reduction in quality, varying directly with the extent of the freeze injury. The practical aspects of the use of freeze-damaged oranges in frozen concentrate production involve a reduction in efficiency of processing operations, a greater possibility of spoilage problems, and a shortening of the operational season as the net result of yield losses, high Brix-acid ratios, poor quality, and other factors.

107 pages. $2.00. Mic 57-3178

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

THE SCANDINAVIAN AND DUTCH RURAL SETTLEMENTS IN THE STILLAGUAMISH AND NOOKSACK VALLEYS OF WESTERN WASHINGTON

(Publication No. 22,155)

Burton Laurence Anderson, Ph.D.
University of Washington, 1957

Two closely knit ethnic groups, one of Hollanders and the other of Scandinavians, located in river valleys of the Puget Sound Region north of Seattle, Washington, are the subject of this comparative study. An investigation into the differences which developed in the use of their environments and the causative factors for this differentiation comprise the body of this dissertation. An analysis was made of the physical milieu and historical development which established the essential equivalency of the areas. The research was accomplished primarily through interview and field schedule, and the results of the findings compiled by ethnic group and aligned one against the other.

Both valleys were settled shortly before the turn of the Twentieth Century and, following the initial phase of subsistence and small scale grain farming, dairying became the primary source of livelihood for each community. Gradually each of the two groups began to develop along divergent lines.

In an attempt to increase their income, the Scandinavians added one commercial field crop after another as farm prices declined prior to 1940. Some of these crops, such as corn and peas, fitted well into the economy, while cash crops such as berries and seed competed with dairying for the use of the land. Many of the smaller Scandinavian farms used their needed pasture and hay land for cash crops. During good years this was profitable, in other years disastrous. The larger farms, which had sufficient acreage to devote a small portion to speculative crops without "crowding" the land, occasionally made high profits which could be used for the purchase of the land of less fortunate neighbors. Commercial packers also acquired farmsteads from bankrupt farmers and operated them to supplement contracted vegetable crops.

The Scandinavian community is rapidly losing its tightly knit quality. The primary reasons for the change are these: the splitting of farms through inheritance and the subdividing of land into uneconomic units; the penchant of the Scandinavians for higher education which attracts most of the youth to other forms of endeavor; discouragement with farming because of long hours and hard work required on diversified farms; and financial difficulties resulting from a too intensive use of the land.

The long term decline in farm prices also affected the Hollanders. Mindful of maintaining soil fertility and reducing financial risk, however, they retained their dairy economy and supplemented their income with poultry raising.

The Dutch community has continued to expand since its inception. In addition to the balanced agricultural program it has adopted, a number of other factors have contributed to its growth. Most of these factors stem from the Hollanders' cultural organization and are briefly these: the patriarchy still observed to a degree by the Dutch wherein the parent furnishes a means of livelihood, usually a farm, for the children; a parochial school system which extends into higher education and successfully insulates the youth from secular society; the religious attitude that "Man is but a steward for the Lord" when applied to land care insures soil preservation practices; and a system of exchange farm work which minimizes capital expenditures and lowers fixed costs on farms.

The results of the differences in operation of the ethnic groups are now observable in the two communities. Lynden, the Dutch hub, is a prosperous growing town while Stanwood, the Scandinavian center, appears to have stagnated. Finally, the Hollanders have expanded from their original settlement into the Stillaguamish Valley where they operate farms previously occupied by Scandinavians.

202 pages. $2.65. Mic 57-3179

SETTLEMENT PROBLEMS RELATED TO FARM SIZE IN THE COLUMBIA BASIN PROJECT, WASHINGTON

(Publication No. 22,160)

James Eugene Brooks, Ph.D.
University of Washington, 1957

The purposes of the dissertation are as follows: (1) to investigate the original objectives of the government's land settlement program for the Columbia Basin Project, Washington; (2) to analyze the farm size and related settlement problems that have developed as that program was applied to the project, and (3) to show how changed settlement conditions may affect total project growth.

The comprehensive settlement program that was developed for the Columbia Basin Project in the 1930's reflects the needs of that decade and previous government land settlement legislation and policy. The leading objective of previous reclamation settlement, the provision of a maximum number of family-sized farms, became the stated goal of land planning. However, the government policy of permitting individuals to own no more than 160 acres was modified for the project. Under the requirements of the Columbia Basin Act, passed to regulate project development, the lands were divided into farm "units" considered sufficient in size to support a family. A family may own only one of these units, which range from forty to 160 acres in size due to variations in land productivity.

Because World War II delayed construction of the irrigation features, the main settlement of the project did not begin until 1952. Although the Bureau of Reclamation is developing the project at an orderly rate, and a settler's

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assistance program has been successful, there is some question whether many of the detailed settlement plans worked out in the 1930's are entirely workable in the late 1950's. Because conditions have changed, many problems have developed. Of great current interest is the question of whether farm unit sizes are large enough for present day conditions.

To discover the nature of the farm size and related settlement problems, a questionnaire was designed and twenty per cent of the experienced farmers in Grant County were interviewed. The survey results indicate that leasing is common among the experienced farmers, for they were operating an average of almost two units each. Most of the farmers felt that (1) one unit is too small to make a living on; (2) there are advantages in farming larger acreages, especially in view of net incomes and machinery efficiency, and (3) farm size should be adjusted to meet the current needs of families, and some size based around 160 acres per family should be adopted.

The farm size problem is related to other settlement problems. Some examples are: (1) wheat farmers, who have withdrawn 280,000 acres from the project, might become interested in re-entering their lands should they be permitted to retain greater acreages to farm. (2) The critical problem of financing the development of new farms is tied closely to expected incomes, which are related to farm size. (3) Violations of the anti-speculation and landownership provisions of the Columbia Basin Act might be reduced if greater farm size is authorized.

The changed settlement conditions may affect total project growth. Adjustments will probably be made in farm size. With full development, farm size will probably average between 1.2 and 2.0 units per family. With fewer but larger farms, it may be expected that there will be about twenty-five per cent less people in the project at full development than currently estimated. Total farm income may not change, but its distribution will be among fewer operators. These changes will most likely affect the character of urban as well as rural growth. Most of the farms, however, will probably be family-operated, so that the goals of Federal reclamation will still be achieved, although in a modified form.

172 pages. $2.25. Mic 57-3180

GEOLOGY

REGIONAL GRAVITY AND GEOLOGIC STRUCTURE IN EAST-CENTRAL MINNESOTA

(Publication No. 22,311)

Budd Berwyn Adams, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor George P. Woollard

For the past 75 years the geology of East-Central Minnesota has been studied in detail. However, because of extensive glacial deposits over the entire region, studies of bedrock geology have been restricted to the area of economic interest and to the few areas of limited bedrock exposure. The present study has been undertaken to delineate the major regional structural features in the more intensively studied areas and to trace these structures across those parts of the area covered by glacial deposits. The gravimetric method was employed for this purpose since subsurface mass variations associated with geologic structure are usually pronounced enough to influence the local gravity field.

The area of study includes most of 15 counties and embraces over 10,000 square miles. Four major geologic provinces are covered: 1) the Mesabi Iron Range west of the Duluth gabbro, 2) the Cuyuna Iron district, 3) the Thomson formation area, and 4) the large area of igneous rocks south of the Cuyuna district and the Thomson formation area.

The anomalous gravity field is found to have the following relations: 1) The Giants Range batholith, adjacent to the Mesabi Range, is characterized by a pronounced gravity low throughout its length; the gravity anomaly extends some 50 miles to the southwest into an area previously mapped as undifferentiated Precambrian and suggests a similar extension of the batholith. 2) About 15 miles south of the Mesabi Range, between the Duluth gabbro and the Cuyuna district, is a pronounced gravity low that is apparently the result of a thick section of light Virginia argillite. 3) Through the Cuyuna district is a sinuous pattern of gravity highs and lows highly suggestive of the folded pattern these rocks are known to have. 4) The elongate gravity anomalies best developed in the Cuyuna district extend with only slight diminution almost half way around the igneous rocks immediately to the south and well across the Thomson formation area. From this relationship the writer has inferred a structural continuity between the Cuyuna district and the Thomson formation area. 5) The area of igneous rocks immediately to the south is for the most part characterized by a large irregular gravity high.

Density measurements on the rock types in the area indicate the following: 1) Metasediments of the Cuyuna series, Thomson formation and Knife Lake group are almost without exception quite massive. All values obtained were closely grouped about 2.80 gm/cc. 2) The Virginia argillite, though similar in appearance, is comparatively light, with values ranging from 2.50 gm/cc to 2.70 gm/cc. 3) The Giants Range granite has a density typical for that rock type and values averaged 2.67 gm/cc. 4) The igneous rocks south of the Cuyuna district are, on the contrary, generally quite dense with values ranging from 2.70 gm/cc to 2.85 gm/cc. For the most part, the high gravity anomalies can be explained as thick sedimentary sections in troughs with adjacent gravity lows over thin sediments and intrusive granites. The two exceptions over the Virginia argillite and southern intrusive rocks are explained by their abnormal densities.

One important result of the present work has been the

discovery of definite evidence of structural continuity in the metasediments around the Central Minnesota Intrusives group. The pattern of folding and thickening forms a semi-circle parallel with the boundary of the intrusive rocks.

In the Cuyuna district, a pattern of deformation has been given which explains the location of most of the areas of iron formation in terms of major folds that were only suggested or inferred previously. In addition, evidence has been found which would continue some of these structures well beyond their present known limits.

199 pages. $2.60. Mic 57-3181

GEOLOGY OF PINTO CANYON AREA, PRESIDIO COUNTY, TEXAS

(Publication No. 21,028)

David Leonard Amsbury, Ph.D.
The University of Texas, 1957

Supervisor: Professor Ronald K. DeFord

Pinto Canyon area includes the southern Tierra Viaja Mountains and the northern Chinati Mountains. Lower and middle Permian silt-stone, limestone, and chert underlie Comanche limestone and sandstone; Gulf rocks were deposited in the area but were eroded from the crest of a north-trending Laramide anticline. Normal faults that trend N3OE cut the anticline before burial by silicic middle Tertiary volcanic strata from several sources. Emplacement of silicic intrusions that range from 1-inch dikes to a 27-square-mile granite-syenite complex followed. Large-scale Basin-and-Range normal faults that trend N5W and N85E displaced the volcanic strata to form the Tierra Viaja, Cuesta del Burro, and Presidio bolson. Gravel, sand, and clay deposited in the bolson are being dissected by tributaries to the Rio Grande.

In ascending order the lithostratigraphic sequence comprises the Wolfcamp(?) Alta formation and the Leonard and lower Guadalupe Pinto Canyon formation (new name), both in the Permian system; the Yucca formation, Bluff formation (lower Albian), Cox formation, Finlay formation, Bienevides formation (middle Albian; new name), Loma Plata limestone (upper Albian; new name), Del Rio formation, and Buda formation (Cenomanian?), all in the Comanche series of the Cretaceous system; and the Jeff conglomerate, Vieja formation (basal Oligocene), Shely group (Oligocene?; new name), Moonstone rhyolite (new name), Petan trachyte (new name), and Chinati Mountain group (emended), all in the Tertiary system. Six terrace gravels were mapped in the dissected Presidio bolson, plus alluvium in present arroyos and the Rio Grande floodplain.

268 pages. $3.45. Mic 57-3182

STRATIGRAPHY OF THE PUGET GROUP AND KEECHELUS GROUP IN THE ELBE-PACKWOOD AREA OF SOUTHWESTERN WASHINGTON

(Publication No. 22,163)

Richard Virgil Fisher, Ph.D.
University of Washington, 1957

The Elbe-Packwood area includes 350 square miles in Lewis, Pierce and Thurston counties, Washington, between west longitude 122°20'-122°40' and north latitude 46°30'-46°50' in the western foothills of the Cascade Mountains.

The rocks are continental in origin and are early Tertiary and late Pliocene(?) in age. The early Tertiary rocks are divided into (1) the middle(?) Eocene Older Volcanics, (2) the upper Eocene Puget Group and (3) the upper Eocene-Oligocene(?) Keechelus Group.

The Older Volcanics are an unknown thickness of andesite flows and pyroclastic rocks. They are tentatively correlated with the Eocene Volcanic Series near Seattle, and with the middle Eocene Northcraft formation in the Centralia-Chehalis area. The Older Volcanics are pre-Puget in age, possibly Middle or lower Upper Eocene, and may be a lower tongue of the Keechelus Group.

The Puget Group crops out in the Tilton River and Nisqually River districts. In the Nisqually River district, the Puget Group intertongues with the lower Keechelus Group. In the Tilton River district, undifferentiated Puget rocks consist of over 9000 feet of sandstone and shale interbedded with volcanic rocks which may be tongues of the Keechelus Group.

The Keechelus Group, ranging in age from upper Eocene to Oligocene(?), consists of at least 10,000 feet, but possibly over 20,000 feet of volcanic breccias, conglomerates, graywackes, pyroclastics and volcanic flows. The clastic rocks are more abundant than the volcanic flows, and volcanic breccias of mudflow origin (lahars) are apparently the most abundant rock type of the region. Andesite is the dominant type of flow; dacite and basalt are subordinate in amount. The Keechelus Group is divided into lower, middle and upper based primarily upon general lithology, and is correlated with the Eagle Creek formation exposed near the Columbia River in southern Washington.

The sequence of early Tertiary rocks has been intruded by sills and dikes which are basic to acidic in composition, although basic intrusions are apparently most abundant.

Unconformably overlying the early Tertiary rocks is the Younger Volcanics, a series of nearly flat lying, Pliocene(?) hypersthene basalts, felsites and volcanic breccias. They may be equivalent to the Pliocene(?) Deep Creek Andesite exposed along the Bumping River in the Mt. Aix quadrangle.

Deformation has produced large, gentle northwest trending folds, and northwest and northeast trending minor faults. Dips average 25° to 35°. The major folding episode of the area probably occurred during late Oligocene and/or early Miocene time.

At least two periods of Wisconsin(?) valley glaciation have occurred, somewhat modifying individual stream shapes and histories, but not the regional drainage pattern.

211 pages. $2.75. Mic 57-3183

THE TERTIARY GEOLOGY OF A PORTION OF THE CENTRAL CASCADE MOUNTAINS, WASHINGTON

(Publication No. 22,166)

Robert John Foster, Ph.D.
University of Washington, 1957

The Central Cascade Mountains lie near the geographical center of Washington. They are composed largely of Tertiary continental and volcanic rocks, and are situated between older metamorphic rocks to the north, and younger volcanic rocks to the south and east. The area discussed in this study was mapped in reconnaissance fashion around the turn of the century. The inaccurate dating of that early mapping was used by the later workers to date the Tertiary history of the Cascade Mountains.

The main structure in the area mapped is a north-south fault through Lake Kachess. This fault separates two different Tertiary stratigraphic sections of the same general age. Evidence north of the area mapped indicates that this is a reverse fault and dips steeply to the east. The youngest rocks cut by this fault are Eucene and it is older than the Snoqualmie granodiorite.

East of the fault, the structures are mostly open and the section consists of the well established eastern Cascade formations. The pre-Tertiary basement rocks are peridotite and Easton schist, both of which are covered unconformably by the Swauk arkose. The Swauk is folded along northwest trends that become almost east-west in the area south of the uplifted pre-Tertiary rocks of the Mt. Stuart block. This change in trend, together with the local origin of some of the Swauk sediments, suggests that the Mt. Stuart block was an important positive element in Swauk time. Locally, the Swauk sediments are covered, apparently unconformably, by an andesitic unit here named the Silver Pass volcanics. Unconformably above these volcanic rocks is the Teanaway basalt, which is followed concordantly by the Roslyn arkose. The Teanaway and the Roslyn have been deformed into a broad structural basin with a steep southwest limb. The nearly flat-lying Yakima basalt lies unconformably on the earlier rocks.

West of the Kachess fault, the structures are more complex, and are in part obscured by the metamorphism that attended the emplacement of the Snoqualmie granodiorite. In this area, most of the mapped units have either been named or redefined by the author. The oldest rocks are the marbles and limy hornfelses of the Denny formation. These metamorphic rocks are overlain unconformably by the sediments of the Guye formation as restricted by the author. Unconformably above the Guye formation is the Mt. Catherine rhyolite. This rhyolite is followed by the intercalated sediments and basalts of the Naches formation. The Naches formation is tightly folded. The Keechelus andesite is mildly deformed and overlies the Naches unconformably. All of the formations in this western stratigraphic column are intruded by the Snoqualmie granodiorite.

Fossils are rare in these continental rocks. The only reasonably well dated formation is the Roslyn which is probably middle or upper Eocene on the basis of one fish, two turtles, and fossil leaves. Fossil leaves indicate a Paleocene or Eocene age for the Swauk and Guye formations and a probable Eocene age for the Naches formation.

207 pages. $2.70. Mic 57-3184

THE STRUCTURAL SIGNIFICANCE OF THE BOSQUE ESCARPMENT, McLENNAN COUNTY, TEXAS

(Publication No. 22,359)

Oliver Thomas Hayward, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor L. R. Laudon

The Bosque Escarpment is an east-dipping multiple cuesta, extending east-north-east across central McLennan county, Texas. In this region it marks the westward limit of the Coastal Plain, and the margin of Upper Cretaceous deposits of the Gulf Coast. The purpose of the present study was to establish the cause for the existance of the escarpment, and to determine its history.

A study of the physiography and drainage of the escarpment led to the conclusion that the escarpment owes its location to the existance of large-scale faulting in the region. Further, it suggests that the faults are downthrown to the east, and that the escarpment is of recent origin.

Areal geology and photo-interpretation support the conclusions above described. The dominant fault-trend is parallel to the escarpment, and the major movement is down-to-the-east.

Subsurface geology based on well-studies confirms these findings. The faults so defined appear to be the northern extension of the Balcones Fault Zone.

It is postulated that the fault zone, and therefore the escarpment, owes its position to the existance of a deeply buried mountain range, the Ouachita System, which is known to underlie the escarpment. It is believed that this feature formed an "anvil" over which Gulf Coast Cretaceous deposits were bent, and eventually broken by subsidence of the Gulf Coast and consequent slippage of the beds east of the Ouachitas into the subsiding Gulf.

137 pages. $2.00. Mic 57-3185

A GRAVITY INVESTIGATION OF THE BARABOO SYNCLINE REGION

(Publication No. 22,364)

William James Hinze, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor George P. Woollard

A total of 907 gravity stations was occupied within a roughly rectangular area, 50 by 65 miles, in south-central Wisconsin. The Baraboo syncline, which is an inlier of folded Pre-Cambrian igneous and metasedimentary rocks in flat-lying Paleozoic sedimentary rocks, is in the center of the investigated area.

The objectives of this investigation were:

(1) to study the degree to which gravity measurements can be used for depicting the surface geology (lithology and structure) of a limited structural feature, the Baraboo syncline;

(2) to determine the extent of the infolded "root" beneath the syncline;

(3) to investigate the degree to which the gravity data

complement other geophysical data, specifically the magnetic measurements taken within the area and seismic crustal studies in Wisconsin;

(4) to analyze various methods of gravity reduction to determine which have the greatest applicability to this type of study.

The gravity measurements when corrected for known variations of the gravitiational field of the earth are shown to be useful in delineating the lithology and structure of the Baraboo syncline. The structure of the syncline is found to be more complicated than is indicated by rock exposure within the area. The gravity data suggests that the syncline may not close at its western end as generally believed, but rather opens to the southwest for about 5 additional miles. A "basic" rock mass in the pre-Baraboo quartzite complex is found to underlie the center of the syncline with a northeast-southwest strike. This rock mass is believed to be either the primary or secondary cause of many of the secondary structures within the syncline. The minimum depth of the deepest portion of the syncline is found to be approximately 2 miles. No evidence of intrusion into the quartzite is indicated by the gravity measurements, nor does the iron-bearing Freedom formation within the syncline result in well defined gravity variations. A major deficiency in mass over the Baraboo syncline is indicated. It is shown that this deficiency in mass is not due to specific gravity variations in the surface rocks; therefore, a deeper source for the mass deficiency is necessary. The deficiency is interpreted as originating from a local increase in thickness of the "granitic" layer of the crust. The thickened layer is computed to reach a maximum depth of 7.7 kilometers beneath the syncline compared with normal values of 1 to 2.8 kilometers. The increased thickness of this layer is either a remnant of a once more extensive "root" of an orogenic belt, or it may be a simple structural thickening. Other large deficiencies in mass found by the gravity measurements in the investigated area are thought to have a similar origin. The regional change in the gravity measurements indicates a gravity minimum in the entire northern half of the area. This gravity minimum is related to a large mass deficiency which covers all of central Wisconsin. It is interpreted in the light of seismic crustal studies as originating from a sharp increase in thickness of the "granitic" layer to the north from 1 to 2.8 kilometers and a slight thickening of the earth's crust in the same direction from 40 to 40.5 kilometers. The increased thickness of the crustal layers may be the remnant of the "root" of an ancient orogenic belt. An analysis of the complementary magnetic study of the Baraboo syncline substantiates the conclusions based upon the gravity investigation.

The gravity measurements over and immediately adjacent to the syncline were analyzed using a vertical gradient and two different second derivative methods. The results of these analyses are quite similar to those from the cross-profile method of resolving "residual" gravity effects. Results using Rosenbach's method of determining second derivatives indicate that this method is most sensitive to local changes in gravity and thus can be very valuable in the study of a limited feature such as the Baraboo syncline. Especially interesting is the close correlation between the results of the vertical gradient method and Elkin's second derivative method.

195 pages. $2.55. Mic 57-3186

SUPERGENE ALTERATION OF ZINC AND LEAD DEPOSITS

(Publication No. 22,067)

Taro Takahashi, Ph.D.
Columbia University, 1957

Characteristic assemblages of the supergene zinc and lead minerals have been observed in the three districts studied. Hydrozincite is the most abundant supergene zinc mineral in the Goodsprings district, Nevada. In contrast, smithsonite is the predominant supergene zinc mineral in the Upper Mississippi Valley district, and smithsonite and hemimorphite are the chief supergene zinc minerals in the Southern Appalachian district. In general, smithsonite is earliest, hydrozincite is next and hemimorphite is latest in the paragenetic sequence of the supergene zinc minerals. In a few cases, hemimorphite which was formed earlier than smithsonite was observed. These observations can be explained by the solubilities of these minerals which were determined by experiments and theoretical calculation. In solutions with a pH between 6.2 and 8.1, being saturated with carbon dioxide under 1 atm.,23^{0}C, smithsonite is least soluble of the three. This range of pH is comparable with ordinary ground water in limestone as shown by field observations in which carbonic and various inorganic and organic acids are infered. This explains the formation of smithsonite as the first mineral in the general paragenetic sequence. In solutions with a pH between 6.8 and 8.1, smithsonite is least soluble, hydrozincite is more soluble and hemimorphite is most soluble. This solubility sequence coincides with the general paragenetic sequence of these supergene minerals. It would appear then, that the pH in the prevailing waters in the districts studied lay between 6.8 and 8.1. In an arid climate, the stability relation between smithsonite and hydrozincite may be a function of partial pressure of carbon dioxide. When the partial pressure of carbon dioxide is lower than $10^{-1.2}$ atm. at 25^{0}C, hydrozincite is more stable than smithsonite. Slow rate of diffusion and entrapment of carbon dioxide gas in rocks in depth may cause the increase of the partial pressure, and consequently cause the increase of smithsonite with depth.

Stability fields of the supergene lead minerals were calculated in terms of pH and Eh using available thermodynamic data. Plattnerite, minium, and vanadate and arsenate minerals can be Eh indicators, and cerussite, anglesite and wulfenite can be pH indicators to predict an environment in which primary minerals have been altered.

The results of spectrochemical analyses indicate that, in supergene facies, the minor elements, molybdenum and arsenic came from galena, and vanadium and phosphorus came from the country rocks.

170 pages. $2.25. Mic 57-3187

A STUDY OF SOME HIGH-LATITUDE PATTERNED-GROUND FEATURES

(Publication No. 22,499)

Richard Spence Taylor, Ph.D.
University of Minnesota, 1956

Adviser: H. E. Wright, Jr.

Detailed investigations were made into the physical characteristics and the hydrologic and thermal regimes of two types of sorted feature, one having its center raised with respect to its borders, and the other having its center depressed. Work was concentrated on the finer-textured depressed-center features in a small study area 12 miles S.E. of Thule, N.W. Greenland.

Repeated precise triangulations and level surveys indicated the rate of movement of surface materials. An additional 2500 levels on several features showed changes of surface form accompanying thaw and freeze-up. More than 500 textural analyses were made, with 250 samples coming from two features. Orientation measurements on 687 cobbles in the 0-6 inch layer of the one feature revealed a pronounced radial orientation. Ground-water levels were measured daily at a maximum of 43 points, and the moisture contents determined on more than 400 samples. In-place densities were measured on several dozen samples, and specific gravities of representative samples were determined. An attempt was made to measure cryostatic pressure with 10 pressure gages in two features. Approximately 10,000 ground-temperature readings were recorded from 128 thermocouples, 112 of them in two features.

Textural analyses revealed stones and granules concentrated at the surface and in the borders by directed congeliturbation, while eluviation and preferential congelifraction have concentrated the fines centrally near the frost table. Because of the lower thermal diffusivity and greater volumetric heat capacity of the fine-grained centers, the sequence of thaw and freeze-up results in (1) a gutter forming under the borders in early spring, (2) topographic reversal of the frost table with a ridge under the borders and a basin under each mesh, (3) freeze-up from all directions toward the center of a mesh. Thus, in the fall each mesh constitutes a closed-system hydrologic cell. This cellular nature extends to the thermal characteristics, for during freeze-up a 'heat cell' exists in the center of each mesh as a result of the latent heat of fusion released from the freezing ground water in the basin. Likewise, a 'cold cell' exists in each mesh in the winter and very early spring. Thus, ground contraction occurs between meshes and within the individual mesh.

Multigelation and congelifraction are most effective immediately above the frost table because of frequent small fluctuations in the position of the latter. These fluctuations occur under the thermal influence of a strong negative temperature gradient from the underlying permafrost during variations in insolation. Sorting is accomplished in many small movements of the individual stones adjacent to the frost table by the force of crystallization of ice growing between the stones and the fluctuating frost table. These movements also impart a radial orientation to elongate stones. Less important frost heaving and sorting may occur during the fall down-freezing of the surface layer.

The moisture within a mesh during freeze-up migrates upward toward the down-freezing surface and is withdrawn downward and laterally to form a nearly uniform layer of ice on the frost table. Freezing in the surface layer results in lateral swelling as well as vertical heave but most of the vertical movement is a result of the growth of the ice layer at the bottom of the 'cell'. It is the presence of this layer of inverted pipkrake (with its cooling surface below) that results in the zero curtain effect in these features and in the small amount of up-freezing. The dehydration of the middle layer of materials diminishes the total amount of heave by causing soil consolidation, and it inhibits cryostatic-pressure phenomena.

299 pages. $3.85. Mic 57-3188

THE GEOLOGY OF THE SAUK RIVER AREA IN THE NORTHERN CASCADES OF WASHINGTON

(Publication No. 22,190)

Joseph Alan Vance, Ph.D.
University of Washington, 1957

The Sauk River area comprises about 260 square miles centering around the town of Darrington which lies on the western flank of the Cascades about 60 miles northeast of Seattle. Geologically the area is complex, including a wide variety of igneous, sedimentary, and metamorphic rocks and structures.

Low grade metamorphic rocks in the Sauk River area include the Gold Hill phyllite and the Shuksan greenschist which were produced by low grade isochemical metamorphism of argillaceous sediments and basalts. These rocks form a large thrust sheet (Whitechuck Mtn. overthrust) which moved from east to west and overlies nonmetamorphic upper Paleozoic sediments. The thrust is cut by the later Straight Creek fault.

The eastern part of the Sauk River area consists of medium and, locally, of high grade metamorphic rocks including biotite schists, orthoamphibolites, and less prominently marble and hornblendite among the isochemical rocks, together with more abundant trondhjemitic and quartz dioritic gneisses of metasomatic origin. The higher grade metamorphics are separated from the low grade metamorphic rocks and nonmetamorphic sediments on the west by a major high angle fault, the Straight Creek fault of probable Tertiary age. A small occurrence of higher grade amphibolites and hornblende gneiss on Helena Ridge, 8 miles west of the Straight Creek fault, is interpreted as a klippe.

The age of the main metamorphism in the present area is not known but is earlier than the thrusting and is definitely pre-Tertiary. Regional relationships indicate that the low angle thrusts are of middle to early late Cretaceous age.

Three units of essentially unmetamorphosed, but strongly deformed sedimentary and volcanic rocks were recognized. They are of upper Paleozoic and possibly in part of lower Mesozoic age. Structurally these units belong beneath the thrusts mentioned above. The uniform structure and nonmetamorphic character of these rocks suggest that they owe their main deformation to a single period of orogeny, which is considered to be pre-middle Jurassic.

Mesozoic sedimentary rocks, principally arkosic siltstones, on Three Fingers may be correlative with the upper Jurassic and lower Cretaceous Nooksack formation. These rocks apparently lie with angular unconformity on strongly folded upper Paleozoic cherts and slates. In middle to early late Cretaceous time the Mesozoic rocks were folded into an open syncline and the underlying Paleozoic rocks were redeformed.

Unconformable continental arkoses, shales, and conglomerates of the Paleocene Swauk formation are preserved in a narrow belt. They were moderately to rather strongly folded before the deposition of the Eocene Barlow Pass volcanics which comprise 4000 feet of gently folded andesitic and basaltic, and subordinately acidic flows, with prominent arkosic interbeds. This sequence is correlated with the Eocene Teanaway and Naches formations.

Basic and ultrabasic igneous rocks are common as dikes and small irregular intrusive bodies in the western part of the area. These intrusive bodies are of several ages, some are pre-thrusting, others are post-Swauk, and at least one is post-Barlow Pass volcanics.

A large quartz diorite stock in the western part of the area is of magmatic origin. It is very uniform in composition, has universally sharp contacts, and is surrounded by an aureole of contact metamorphism. The quartz diorite cuts the Swauk and is of Tertiary age.

A steep-walled pipe of andesitic breccia at Round Lake is a remnant of a late Tertiary volcano. Physiographic evidence indicates that this volcano was built prior to the elevation of the Cascades to their present level, probably at a time when a lower ancestral Cascade Range with several thousand feet of relief was already present.

Two distinct episodes of late Pleistocene glaciation are recognized. The first was alpine glaciation by Cascade valley glaciers which shaped the present river valleys. The second was the advance of Puget Sound ice into the mountain valleys, after the decline of the Cascade glaciers. The Suiattle River is believed to have been diverted during glaciation to its present northward course into the Skagit River. Thick ash fill terraces in the Sauk, Suiattle, and Whitechuck River valleys and an ash layer several inches thick on many of the gentler ridge crests are correlated with a Glacier Peak eruption dated by Rigg and Gould at about 6800 years ago.

333 pages. $4.30. Mic 57-3189

ENERGY OF THE EARTH'S ROTATION APPLIED TO THE DEFORMATION OF SOUTHERN CALIFORNIA

(Publication No. 22,219)

Charles Philip Walters, Ph.D.
Cornell University, 1957

Many modern tectonic theories treat the earth as a non-rotating body, while the energy of the earth's rotation is very great in regions near the equator. Some consideration was given to the east-west deformational effect of the earth's rotation early in this century, but the force has been considered ineffective by most theorists since that time. The present state of knowledge of the earth calls for a reconsideration of this force.

Sinking of a large segment of the earth causes an eastward movement of the segment with respect to the rest of the earth while rise of a large segment causes a lag against the earth's rotation, or a westward pressure. Size of the segment and rate of vertical movement are important in determining the effectiveness of the pressure. The concept of rheidity makes the hypothesis more attractive by favoring plastic failure under certain conditions.

The Pacific basin is considered as a sinking segment of the earth. It is so large that it tends to change the rate of rotation of the earth, but must do so by delivering pressure against the Americas. Southern California is considered in some detail. Eastward pressure from the plastic Pacific segment is greatest in the low latitudes, least in the high latitudes. North America, as a rising segment during the time of Pacific sinking (Cenozoic), has resisted the flow of plastic material, which is deflected northward toward the Gulf of Alaska. This movement is responsible for the San Andreas fault. East-west belts of deformation in the Pacific indicate differential flow eastward. From one of the Pacific segments, the Deep Plain in the latitude of central California, an eastward underflow of plastic material caused the thickening and rise of the Sierra Nevada mass. This rising segment exerted pressure westward and deformed the weak Coast Range-San Andreas zone.

The bending of San Andreas fault was followed by further northward movement of the west side of the fault. This distorted the crust of part of Southern California and the continuing distortion is the Pasadenian Orogeny.

The rest of the Pacific border is examined. A break-through of the deep Pacific material is noted in the Central America-Caribbean area. Underthrusting is noted along the coast of South America. Another break-through of plastic material occurs between South America and Antarctica. Australia and Asia have fallen in behind the eastward-retreating Pacific segment and are moving toward the equator. 63 pages. $2.00. Mic 57-3190

HEALTH SCIENCES, GENERAL

SOME OBSERVATIONS ON THE HEMATOLOGICAL FUNCTION OF THE STOMACH

(Publication No. 22,485)

Lloyd Douglas MacLean, Ph.D.
University of Minnesota, 1957

The infrequently reported development of pernicious anemia following total gastrectomy which on the basis of previous knowledge should occur, led to the use of orally administered radioactive vitamin B_{12} as an assay of intrinsic factor in normal humans and in patients with total gastrectomy, proximal subtotal gastrectomy, various types of distal subtotal gastrectomy, achlorhydria, pernicious anemia and gastric polyps. This investigation suggested that pernicious anemia would occur following total gastrectomy and proximal subtotal gastrectomy if pernicious anemia is not a more complex deficit than a lack of intrinsic factor.

Further study on the incidence of pernicious anemia after microscopically proved total gastrectomy at one institution, revealed that in those patients who did not receive prophylactic parenteral liver extract or vitamin B_{12} the occurrence of an anemia indistinguishable from pernicious anemia was inevitable 3 years or longer after the total removal of the stomach.

Patients with proximal subtotal gastrectomy with esophagoantrostomy likewise fail to absorb orally administered radioactive vitamin B_{12} and develop pernicious anemia after 3 years following surgery. The likelihood is that intrinsic factor is secreted in the human from the body and fundus of the stomach only and not from the antrum, duodenum or remaining portion of the gastrointestinal tract. Pernicious anemia rarely occurs following distal subtotal gastrectomy. When this does occur examination of the resected portion of stomach reveals an atrophic mucosa almost or completely lacking in parietal and chief cells. The postulate is made that the remaining gastric mucosa in such cases is not of sufficient quality to meet physiological needs.

It has been demonstrated using chromatographic techniques that vitamin B_{12}-Co^{60} absorbed from the gastrointestinal tract and excreted in the urine is in that form and is not a degradation product. This test was considered a reliable measure of intrinsic factor production and was used to differentiate achlorhydria and achylia gastrica in the human for the purpose of detecting those patients most likely to develop gastric cancer in the future.

232 pages. $3.00. Mic 57-3191

THE PROGRESSION OF EXPERIMENTAL ATHEROSCLEROSIS FOLLOWING LUMBAR SYMPATHECTOMY

(Publication No. 22,486)

Thomas Ogden Murphy, Ph.D.
University of Minnesota, 1957

Chairman: Richard L. Varco, M. D.

Since the introduction of sympathectomy to produce a local and permanent vasodilatation of a segment of an arterial bed, there have been few studies of the effect of this procedure upon the primary disease which necessitated the operation. The following is a brief summary of our experiments in rabbits:

1. 12 animals with a sympathectomy and aortic stripping on an alfalfa diet. No atherosclerosis.
2. 12 animals with aortic manipulation without sympathectomy on an alfalfa diet. No atherosclerosis.
3. 24 animals with a sympathectomy and aortic stripping on a cholesterol diet. Severe lumbar aorta and femoral atherosclerosis.
4. 24 animals with an aortic manipulation without sympathectomy on a cholesterol diet. Little atherosclerosis below the renal arteries.
5. 12 animals without surgery on a cholesterol diet. Little atherosclerosis below the renal arteries.

These studies show an increase in the extent of atherosclerosis in all of the sympathectomized animals not only in the lumbar aorta but also in the smaller vessels of the pelvis and thigh. These studies suggest that if there is a disturbance of the cholesterol and lipoprotein metabolism, the effect of sympathectomy upon the arterial segment involved may be adverse.

113 pages. $2.00. Mic 57-3192

HEALTH SCIENCES, HYGIENE

ON THE INTERSTRAIN VARIATIONS OF SCHISTOSOMA JAPONICUM

(Publication No. 22,085)

Shu-ying Li Hsŭ, Ph.D.
State University of Iowa, 1957

Chairman: Associate Professor Kenneth MacDonald

Cercariae of Schistosoma japonicum from the infected oncomelanian snails originating from four endemic areas

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

- Chinese mainland, Formosa, Japan, and the Philippines - have been used to infect a number of laboratory animals for the study of the interstrain variations of this parasite.

The results indicate that interstrain variations of this parasite are shown in (1) the length of adult worms, (2) characteristics of the male sexual glands, (3) size and shape of the eggs, and (4) the duration of the prepatent period.

It has been concluded that each geographical strain possesses certain district characteristics which can be used to differentiate one strain from the other. One strain may have certain characteristics similar to another sister strain on the one hand, and have other characteristics similar to another sister strain on the other hand. The study shows that each geographical strain has developed its own characteristics in the course of its evolution, although all the four strains may have originated from one ancestral stem. 41 pages. $2.00. Mic 57-3134

HEALTH SCIENCES, PHARMACY

A DILATOMETRIC STUDY OF MELTING BEHAVIORS OF SOME FATS, WAXES AND RELATED SUBSTANCES OF PHARMACEUTICAL IMPORTANCE

(Publication No. 20,647)

Louis Joseph Ravin, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Takeru Higuchi

The study which has been described has utilized dilatometric techniques to investigate the phase relationships of a number of compounds commonly used in pharmaceutical systems. Particular attention was paid to the melting dilation of the following compounds and mixtures: polyethylene glycol 4000, polyethylene glycol 6000, polyethylene glycol 20000, a mixture of polyethylene glycol 4000 and polyethylene glycol 6000, spermaceti, cetyl alcohol, a mixture of spermaceti and cetyl alcohol, a mixture of spermaceti and polyethylene glycol 4000, a mixture of cetyl alcohol and polyethylene glycol 4000, and white wax, and to the effect of rapid temperature changes on the phase transitions of monostearin, distearin, tristearin, white petrolatum, polyethylene glycol 1500 and theobroma oil.

The behavior of the polyethylene glycols differs from the other simple mixtures in that they exhibited no well defined inflection points. An explanation for this behavior may be found in the fact that all components form a stable solid solution miscible in all proportions. Their melting dilation appears to decrease, however, with an increase in molecular weight. When two immiscible substances, spermaceti and polyethylene glycol 4000, are mixed, they melt independently and their mixing has a very slight effect on the final melting point of the individual components. Contrary to this, when two miscible substances, spermaceti and cetyl alcohol, are mixed, they do not melt independently and their mixing has a pronounced effect on the final melting point. The individual melting points of the components are not detected in this case.

The effect of slow and rapid cooling on the phase behavior of polyethylene glycol 1500, white petrolatum and theobroma oil has also been studied. Sudden temperature changes did not appear to lead to the formation of metastable forms in the case of white petrolatum and polyethylene glycol 1500. Rapid cooling, on the other hand, produced unstable modifications very readily in theobroma oil. The dilatometric results obtained indicated that the transition to the more stable form for this material took place below room temperature.

Spray drying of stearins caused the appearance of metastable forms. The amount of polymorphic modification present varied with the solvent employed in the spraying process. The overall effect, however, is probably due to a combination of several physical phenomena occurring during the process. The degree of instability produced by spray drying decreases from mono-, to di-, to tristearin in most cases. Alcohol has been shown to be the best solvent available for the spray drying of glycerides since it apparently causes the least instability.

The dilatometric information obtained from this study may be useful in determining why many ointment preparations undergo gradual changes in their physical appearance and rheological properties, why enteric coatings on standing present varying degrees of resistance to body fluids and why suppositories which have been cooled too rapidly exhibit anomalously low melting points.

95 pages. $2.00. Mic 57-3193

HISTORY, MEDIEVAL

THE MATHEMATICAL THEORY OF PROPORTIONALITY OF NICOLE ORESME (ca. 1320-1382)

(Publication No. 22,350)

Edward Grant, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Marshall Clagett

The purpose of the thesis is to edit, from Latin manuscripts, and to analyse the strictly mathematical portions of two works on proportionality by Nicole Oresme, a fourteenth-century French theologican, philosopher, translator, and mathematician.

The first and most important work (possibly written in or before 1360) is the De proportionibus proportionum, which consists of six chapters. Only the first three chapters are edited and discussed here. Five manuscripts of the fourteenth and fifteenth centuries and an edition printed at Venice in 1505 were utilized to establish the text.

Any consideration of Oresme's treatment of proportionality must begin with the Tractatus de proportionibus of Thomas Bradwardine. Written in 1328, it introduced an innovation into medieval physics which served as the point of departure for almost all of the fourteenth and fifteenth century mathematical discussions of motion. In order to avoid certain difficulties arising from Aristotle's statements implying that velocity is a direct function of a ratio of force and resistance, Bradwardine devised an exponential function which may be represented in modern terms as $F/R = (F'/R')^{V/V'}$, where F is force or motive power, R the resistance, and V the velocity. This function, where the proportions of force and resistance are exponentially related with the exponent expressing the arithmetical proportion of velocities, came later to be invoked when it was said that "velocity follows a proportio proportionum."

It appears that Oresme was the first scholastic to feel the need for furnishing a firm mathematical background for the Bradwardinian rule rather than simply applying it to physical problems.

The most important point in Oresme's De proportionibus proportionum is the non-Euclidian interpretation given to the term pars and commensurabilis. A part designates a unit proportion which is the common measure or exponential base of another proportion or proportions. Thus 2/1 is said by Oresme to be a one third part of 8/1 since $2/1 = (8/1)^{1/3}$, and these two proportions are commensurable in Oresme's special exponential sense. However, 6/1 and 8/1 are incommensurable because they have no unit proportion of integers as their common measure; that is, they have no common base. In the same way an irrational proportion and a rational proportion can be commensurable. For example, $(3/1)^{1/3}$ is commensurable to 3/1, since it is exponentially a one third part of 3/1.

From his interpretation of pars and commensurabilis, Oresme arrives at the concept of an irrational exponent expressed as an irrational proportion which is not a part of any rational proportion. In modern terms we can express this concept by saying that B, an irrational proportion, is not equal to $(A)^{1/n}$, where A B, A is a rational proportion, and n is any integer.

The highlight of Chapter III is Oresme's discussion of "mathematical probability". He "statistically" shows that any two unknown rational proportions are probably incommensurable in the exponential sense already noted.

The Algorismus proportionum (written in or before 1361) is divided into three tracts. The thesis includes an edition and analysis of only the first tract. Thirteen manuscripts were used in the preparation of this edition. Tract one has nine rules on the manipulation of exponents or rational and irrational proportions. The main objective is to express every irrational proportion as an exponential part of some proportion. This is equivalent to expressing any irrational proportion B in the form $(A)^{1/n}$, where A is a rational proportion and n is an integer.

The Algorismus implicity assumes, without demonstration, some of the conclusions that have been demonstrated in the De proportionibus proportionum. This, however, does not mean that the former treatise was written after the latter. For there is no evidence - external or internal - which establishes conclusively the order of composition.

373 pages. $4.80. Mic 57-3194

DE PRINCIPIIS NATURAE OF ST. THOMAS AQUINAS: CRITICAL EDITION

(Publication No. 22,142)

Rev. Basil M. Mattingly, O.S.B., Ph.D.
University of Notre Dame, 1957

Aims: Using the extant sources (59 MSS and 8 incunabula) for this medieval tract, this research sought 1) to establish a critical edition; 2) to use the very establishing thereof as a test case for ascertaining: a) whether a critical edition is possible without an extant autograph or certified apograph, b) whether presently accepted codicological evaluations and consequent applications are valid.

Method: 1) Assuming the general fidelity for any given Ms to be maintained throughout the coverage of a single tract, 2) the comparative reliability of each was sampled on a basic text, established by a provisory exclusion of all problematic readings; this reliability was distinguished according to these special values: omissions, additions, variant expressions, inversions. 3) These evaluations then served to regulate the gradual re-integration of the text. 4) The assumption of 1) above was constantly checked by repeating the comparison of 2) above at each of three

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

stages of gradual incorporation of the problematic into the text.

Results: A marked and confirming uniformity obtained throughout, and the final calculations for all the matter differed only quantitatively from the starting evaluations on the limited basis of the expurgated text.

Conclusions: This critical control of the materials and thereby critical control of the text in its progressive stages of determination, together with the full report of all deviations in a non-selective apparatus, justified calling this a critical edition. Further, no generalized value can be a priori assigned any whole codex collection; the unit for evaluation is the fascicle or quire.

355 pages. $4.55. Mic 57-3195

PROPHECY AND HUMANISM IN LATE FIFTEENTH CENTURY FLORENCE: A STUDY IN THE RELATIONS BETWEEN SAVONAROLA AND THE FLORENTINE HUMANISTS

(Publication No. 22,111)

Donald Weinstein, Ph.D.
State University of Iowa, 1957

Co-Chairmen: Professor W. O. Aydelotte and Mr. Giles Constable

This is a study of the background and formation of Savonarola's prophetic message, and of its reception by the humanists of Florence at the end of the fifteenth century. It shows that the Joachimite millenarian tradition continued into the late fifteenth century and constituted one source of Savonarola's ideas. It emphasizes the importance of political events in Florence in the 1490's for the development of Savonarola's prophecy, and it suggests that Savonarola absorbed some of the traditional Florentine ideas of civic humanism and patriotism in forming his message.

The study shows the interest in prophecy and religious reform among the Neoplatonists of the Platonic Academy in the late fifteenth century and describes its multiple roots in Christian, ancient, and Hellenistic thought. It contends that these interests explain the enthusiastic reception given to Savonarola by most of the leaders of "modern" thought in Florence. The works written by contemporary Florentine humanists in favor of Savonarola and his piagnone movement are examined. Among the more important authors studied are Marsilio Ficino, Giovanni and Gianfrancesco Pico della Mirandola, Girolamo Benivieni and Giovanni Nesi. The question of Savonarola's influence upon them is discussed, and the ways in which they applied their philosophical and political ideas to Savonarola's prophecy are shown. To these men Savonarola was the embodiment of their ideas, and his message the fulfillment of their hopes.

The dissertation concludes that Savonarola was not merely a traditional revivalist preacher but one who faced the problems of his time with a program which combined contemporary political, and intellectual, as well as visionary, aspects. It shows that in important respects his message harmonized with the program of the humanists. Finally, it argues that the interest of the Florentine humanists in religious reform, partly dating from before Savonarola, partly owing to his influence, contravenes the distinction, frequently made, between the northern and the Italian humanists.

The principal materials for this study are the sermons of Savonarola and fifteenth and sixteenth century Joachimite and humanist writings, both in books of the period and in manuscript. 332 pages. $4.25. Mic 57-3196

HISTORY, MODERN

THE PROBLEM OF LAW AND ORDER IN IRELAND, 1812-1836

(Publication No. 22,443)

Galen Broeker, Ph.D.
University of Minnesota, 1957

Adviser: A. L. Burt

One of the major problems confronting the administrators of Ireland during the first half of the nineteenth century was the problem of law and order. Feared and distrusted by those who governed them, and without effective legal means to redress their political, economic, and religious grievances, the Irish peasants used organized violence in a primitive attempt to enforce the will of the majority upon the intrenched, privileged few of Ascendancy Ireland. From the date of the Union until roughly 1837, Ireland was seldom free from violence or the threat of violence. In 1815, 1822, and 1831, large sections of the south and west were under the control of peasant "armies," and in 1829, it was the threat of a religious war which won Catholic emancipation for Ireland. So incendiary a situation could hardly be tolerated by any government, but efforts to improve the near-insurrectionary state of the Irish countryside by force met with resistance from outside factors that were to exercise a decisive influence on the evolution of a system of law enforcement. The traditional approach of the Government towards Irish violence lay in the use of the army and in coercive legislation, but during the last years of the Napoleonic wars, a military force of sufficient size to cope with agitation as widespread as that in Ireland was not available. Following the end of the wars, the traditional British opposition to a standing army, coupled with economic considerations, reduced the military establishment to such an extent that Ireland continued to be denied sufficient military strength to suppress the opposition of the Irish peasants. Without the protective cover of the army, the other instruments of law-enforcement, especially the magistracy, collapsed; in 1813 began the long process of rebuilding the system.

The Peace Preservation Force of 1814 was designed to suppress agrarian violence, and to punish the magistrates who failed to perform their duties by making the residents of the disturbed area pay the deliberately inflated costs of the Force. But opposition to this policy was so widespread as to limit the usefulness of the Force, and in 1822, the County Constabulary was formed. To make this police system effective, an attempt was made to "purge"

the magistracy of its undesirable members, but to no avail, and under the strain of the emancipation crisis and the "tithe war," the Constabulary proved unable to maintain law and order. From the long search for a civil solution to the problem of agrarian violence, a unique police force evolved in 1836, intended as a substitute for the army, and incorporating certain powers of the magistracy. This was the famous Irish (later Royal Irish) Constabulary.

But the development of the Irish Constabulary involved more than the creation of a substitute for the army. In 1822, the attitude of the British Government towards the problems of agrarian crime underwent a change brought about by a realization that reform might succeed where coercion had failed. To those responsible for Irish affairs in the 1820's, it was clear that the reforms that must precede all others were those that would assure the efficient and impartial administration and enforcement of the law, for only by ending Irish sedition, violence, and crime could the proper "moral climate" be created for inaugurating other reforms. Thus the development of an effective and, above all, an impartial system of enforcing law and order came to be seen not only as a problem of administrative improvement, but also as one of social reform. 407 pages. $5.20. Mic 57-3197

THE SOCIAL POSITION OF A FRENCH LAWYER (1718-1763): AN APPRAISAL OF THE ADVOCATE BARBIER

(Publication No. 22,126)

John Woodruff Carson, Ph.D.
The University of Nebraska, 1957

Adviser: Glenn W. Gray*

One of the few journals, the only extensive one, kept during the eighteenth century by members of the bourgeoisie was that of E.J.F. Barbier, who practiced law in the Parlement of Paris. Since its first publication in 1849 this work has been accepted, partly for want of material of this kind, as a primary source for the attitude of the bourgeoisie for the period it covers, 1718-1763. It has been the purpose of this investigation first to seek in Barbier's comments on affairs of the day an image of the man himself in his social setting; then to decide whether this image supports or contradicts the larger hypotheses concerning the role of the bourgeoisie in the events of the eighteenth century. In either case analysis of the motives and drives of a given individual might prove useful in a number of present attempts to test social theories in historical periods. A simple case study can of course do no more than suggest possible explanations and outline areas for further investigation, which could take the form of statistical studies or additional efforts to provide biographical material.

Results of the investigation indicate not only that Barbier fails to conform to the historian's stereotype of the eighteenth century bourgeois, but also suggests that the element of dynamism in the class itself may have been overstated. Barbier's lack of ambition may have reflected the position of the legal group rather than that of the comprehensive class called the bourgeoisie, but his desire to identify himself with a group guarding, not extending, its status, finds echo in almost all groups of the bourgeoisie in the old regime.

Gifted with a facility for analyzing men, not institutions, Barbier simply could not envisage a dialectically altered constitution or a social structure in the process of change. If an intelligent class has any responsibility toward gradual correction of what may otherwise precipitate violent destruction, then Barbier fell decidedly short of meeting his responsibility. His contentment with things as they were negates any consideration of Barbier as part of a "blocked class," even though other groups within it, such as the financiers, may indeed have felt frustrated. If Barbier was typical, the lack of evolutionary change in his age is understandable. Even when the bourgeoisie might have been stirred to a consciousness of its own possible political role by observing the performance of the Parlement of Paris, for instance when it refused to support an improvement in the government's fiscal structure, the implications were not grasped by Barbier. After nearly fifty years Barbier abandoned his journal. Fifteen years of propaganda of the enlightenment had scarcely affected him. The answer to the question of whether the enlightenment actually did move men of Barbier's character to points of view which they could not reach by the reaction of their wits to the force of events, it transferred to generations following Barbier. Not all lawyers of Barbier's position went the same way in 1789-1792. The implication from this case study is that the legal group of the bourgeoisie, in order to furnish leadership in the subsequent revolution, must have received other and later stimuli than those that affected Barbier. Barbier himself was not a pioneer of the revolution but a pillar of the old regime. 273 pages. $3.55. Mic 57-3198

*The study was first suggested by and pursued under the supervision of Dr. Eugene N. Anderson, who was later replaced by Dr. Glenn W. Gray as chairman of the committee.

WASHINGTON'S EXPERIENCE AND THE CREATION OF THE PRESIDENCY

(Publication No. 22,127)

Lois E. Christensen, Ph.D.
The University of Nebraska, 1957

Adviser: James L. Sellers

The war of the American Revolution was carried on by the Continental Congress, a legislative body with no real authority. Because it lacked power and was plagued by jealousies between States, it needed strong executive leadership and guidance. It was the problem of this writer to observe how General George Washington supplied this leadership. The writer also wished to illustrate how Washington's experiences with Congress influenced his concept of what the Executive power should include, and how he applied the lessons learned from his military experiences during his tenure as our first Chief Executive.

This problem was studied in the main through Washington's letters from 1775 to 1797. In addition, the writer

also consulted the records of the Continental Congress and the Congress of the United States, the writings of some of Washington's contemporaries, and some outstanding secondary works.

From this study it appears that during the War for Independence, Washington on many occasions supplied the initiative for subsequent Congressional action. He kept Congress well informed of the state of the Army and its needs. His suggestions for the guidance of Congress were patiently and persistently repeated until results were obtained. An excellent example was his long effort to obtain a half pay and pensionary establishment for officers of the Continental Army. When occasion demanded, Washington used his personal friendship and influence with individual delegates to Congress to obtain Congressional action. Although plagued by shortages of every type, he kept an American Army in the field until foreign aid was secured and victory achieved. On a number of occasions, it was Washington's influence alone, on both the military and civilian levels, which kept the Revolution alive.

Following the war, Washington used his influence to secure changes he felt were necessary in the government of the United States. The Philadelphia Convention of 1787 drew a frame of government which provided for a single, independent Executive, a President vested with the executive power of the nation. Elected unanimously to this office for two terms, Washington used the executive power provided by the Constitution to organize and put into operation the product of the Philadelphia Convention. Knowing from experience the type of guidance needed to keep Congress at its task, he provided the guidance and leadership necessary for this. His military experience had taught him the value of capable and dependable men of good character in positions of responsibility; hence, he exerted great effort to secure the services of the most capable men in America as his assistants. Although the unity of his Cabinet was shattered by the growth of partisanship during the second administration, Washington tried to hold himself and his administration above party. In the field of foreign relations, he used the executive prerogative to keep the United States out of the European war. He further emphasized the neutrality of the United States when he forced the recall of French minister Genet for actions which imperiled that neutrality. He was successful in negotiating a settlement of differences with Great Britain and with Spain. Treaties were negotiated with Indian tribes. He maintained the independence of the Executive in the face of an attack by the House of Representatives, and in spite of the pressure of adverse public opinion.

Through his administrative experience and through the force of his character, Washington gave the American Presidency the place of pre-eminence in the American constitutional system. He realized that the nation must have singleness of purpose and that this could be expressed best through the Executive.

430 pages. $5.50. Mic 57-3199

FRENCH ATTITUDES TOWARD THE "GERMAN PROBLEM", 1914-1919

(Publication No. 22,128)

Robert Eugene Cleveland, Ph.D.
The University of Nebraska, 1957

Adviser: Robert L. Koehl

As one studies the development of French thinking toward Germany during the years 1871 to 1919, one becomes aware that the search for a simple explanation is certain of failure. To state that an inevitable conflict divides the French and German peoples is neither accurate nor sufficient. To be satisfied with the "healing of the open wound" of Alsace-Lorraine as the basis for French policy is to deny certain facts. At one point during World War I the average Frenchman, if not the Government, would have settled for a peace which did not involve the return of the two provinces. On the other hand, many prominent French groups and individuals were thinking in terms of a peace which involved much more than the return of the two provinces.

National pride, loss of territory, the obligations of the Russian alliance were all reasons for French willingness to risk a war with Germany. It is doubtful, however, whether they were, individually or together, the cause. The basic explanation for such a policy seems to be the desire of the French people, and successive French Governments, for security. Between 1871 and 1914 France became increasingly aware of the inequalities of the power relationship between the two states. Their leaders realized that France, alone, could not hope to challenge Germany and, therefore, their only hope was in an alliance with one or several other European powers.

On the eve of the war France was faced with the possibility of an immediate war with Germany or the collapse of the Triple Entente. The leaders of France, especially Raymond Poincaré, felt that the only chance France had to achieve security from attack by a growing Germany was in the maintenance of the balance of power.

The French people, after an initial patriotic flurry of defense, gradually became war-weary. Their sentiments along this line, however, were never strong enough to produce any statement of policy from the Government. The German offer of peace in 1916 was refused and without serious opposition, except for certain Socialist elements. When it became apparent that the Germans had been stopped, if not defeated, the Government began to announce certain aims that were to be the object of French policy. Then, when Great Britain and the United States began to state aims that were inadequate as far as France was concerned, the French Government adopted a policy of silence and refused to commit itself to any program that was not total and complete with respect to such points as reparations, territorial compensations, the Rhineland, secutiry, etc.

Throughout this entire period one is impressed with the singular roles played by such leading figures as Poincaré and Georges Clemenceau. As President of the Republic, Poincaré used his power to appoint the Premier to place in office men who would pursue a vigorous policy toward Germany. To achieve this aim, and bowing to popular clamor, he appointed Clemenceau as the last wartime Premier. As Premier, Clemenceau assumed virtually

sole responsibility for the securing of French interests at the Peace Conference. The conflict of interests which faced him were great; but in the final analysis he saw that compromise was necessary, and he settled for the strongest terms he felt were obtainable.

These terms included the return of Alsace-Lorraine, a customs union between France and the Saar for fifteen years, the demilitarization of the Left Bank and the bridgeheads of the Rhine, a vague guarantee by Great Britain and the United States against an attack on France by Germany, and an indefinite amount of reparations.

313 pages. $4.05. Mic 57-3200

JAPANESE ANNEXATION OF KOREA: A STUDY OF KOREAN-JAPANESE RELATIONS TO 1910

(Publication No. 16,932)

Chon Dong, Ph.D.
University of Colorado, 1955

Supervisor: Professor Earl Swisher

This thesis is a study of Korean-Japanese relations from the earliest times to 1910. There has been some discussion of the rise of modern Japan, but no one has ever seriously investigated the development of the first step in Japanese continental expansion (the conquest of Korea) which paved the way for the Japanese invasion of Manchuria and China, and then finally brought about the Second World War.

In discussing the history of Japanese absorption of Korea, it is necessary to investigate Far Eastern international relations as well as national policies in the East not only those of Japan and Korea but also those of China and Russia; because Korea, occupying the geographical center of the Far East, has constituted the basic factor in the Far Eastern politics and been the cause of both great Far Eastern wars, namely the Sino-Japanese and the Russo-Japanese. Therefore, the history of the Japanese annexation of Korea is, to a great extent, the history of Far Eastern power politics, and the writer has attempted to point out American as well as European participation in the struggle over Korea.

Next to the peninsula of Korea, it was Manchuria which became a focal point of the struggle for world power and played an important role in the Russo-Japanese contest over Korea. It is interesting to note that these two regions -- Korea and China -- have been the only part of the world where collective punitive action has ever taken place (the international expedition against the Boxers and the United Nations action against the North Koreans). Being conscious of this fact, the writer has attempted to study Korean-Japanese relations in the light of international relations of the East as a whole, rather than confining his attention to the aggressive actions of Japan alone.

The thesis is divided into three parts: Korean-Japanese relations to the opening of Korea (1876); the international struggle over Korea (1876-1905); and the Japanese annexation of Korea (1905-1910). The first part covers from the earliest contacts of the two peoples through the Mongol and Hideyoshi invasions of the thirteenth and the sixteenth centuries. Materials for this period are chiefly Oriental sources, such as Korean, Chinese (dynastic histories), and Japanese sources, including English translations.

The second part deals chiefly with the Sino-Russo-Japanese contest over Korea. The chief source material for this period is the Korean Repository, an American missionary journal published in Seoul which includes not only eye-witness accounts of the events in Korea, but a considerable amount of information on early Korean history. Discussions on international relations are based primarily on official documents and memoirs of the participants of that period. It was in this period that Japan, with the restoration of Meiji, modernized her army and navy, forced Korea to open its doors, drove China and Russia out of Korea, became a world power, and secured a dominant position in Korea and in the Far East.

The third and the last part covers the final stage of the Japanese annexation of Korea. For this period the writer obtained a valuable body of source material entitled Nikkan Kappo Hi-Shi (The Secret History of Japanese Annexation of Korea) not previously used by any western writer. It contains the important letters, instructions, reports, and speeches of Japanese and Korean annexationists. Practically every secret activity for the annexation can be found in this private compilation, and the third part of this thesis is based almost wholly on this material.

The chief problem of the writer was the translation of Korean or Japanese into sensible English idiom without losing the original meaning. Another problem was the reliability of the sources. The writer took Itō-Kō-Jen-Shū (Works of Prince Ito) and eye-witness accounts of such participants as Hulbert and McKenzie at almost face value. He regarded the material in Nikkan Kappo Hi-Shi as reliable source; because it was compiled by an official of Kokuryukai (Black Dragon Society), published by the Black Dragon Society Press, and the Japanese annexationists were either members of Kokuryukai or closely associated with that society. For the general history of Korea, the writer depended chiefly on Kuk-Sa-Kai-Sul (Outline of National History by Seoul University National History Research Room), because it is probably the most reliable and the best account of Korean history produced so far.

Having investigated the background of Japanese annexation of Korea with the sources available to him, the writer is led to conclude that Korean-Japanese relations began as early as the fifth century. Japan indicated her aggressive tendency toward the continent from the beginning of her relationship with Korea, and this reached its first climax in the Hideyoshi invasions in the closing years of the sixteenth century. Then the opening of Japan by Perry in 1854 marked a new era not only of Japan but of the East. Japan within a half century modernized herself and changed the Chinese-dominated Asiatic politics and civilization into a new Japanese-dominated Asia after defeating her rivals (China and Russia) with her modernized army and navy. Helpless Korea, beginning with the opening of her doors first to Japan and then to the West, became a pawn in this political and cultural conflict in the East. Within a quarter of century (1905) Korean sovereignty was gone, and in another five years (1910) her territory became a colony of the Japanese Empire.

391 pages. $5.00. Mic 57-3201

JUGOSLAV UNION AND THE BEGINNING OF THE SERB-CROAT CONFLICT, 1918-1923

(Publication No. 21,806)

Matthew Mark Mestrovic, Ph.D.
Columbia University, 1957

The Kingdom of Serbs, Croats, and Slovenes, established in 1918, comprised four distinct Slavic national groups: Slovenes, Croats, Serbs, and Macedonians. The Serbs and Croats were the most numerous groups, comprising respectively 43 percent and 29 percent of the population of the country.

Jugoslavia was above all a Serb-Croat state. It could be strong only if built upon genuine Serb-Croat understanding. Yet from the very establishment of Jugoslavia, the national aspirations of the Croats and Serbs sharply clashed spawning a bitter conflict, a conflict which impeded the economic development of the country, undermined constitutional and democratic government, and led to repression and police rule that culminated in a fratricidal struggle during the Second World War and the subsequent establishment of Communist rule.

This dissertation traces the historical background of the two national groups from medieval times and discusses the growth of tensions between them, especially in the nineteenth and early twentieth centuries. The Allied victory in the First World War made it possible for the Croats and other South Slavs in the collapsing Austro-Hungarian Empire to unite with victorious Serbia and form a Jugoslav state. But the efforts of the Jugoslav Committee in exile during the war to create a Jugoslavia within which Serbs, Croats, and Slovenes would be equal partners met with hostility on the part of Pašić, the Serbian Premier, and other Serbian leaders who desired that the new state be Serbian dominated.

Although Pašić capitulated to the Jugoslav idea embodied in the Corfu Declaration of 1917 he later renounced it as mere propaganda and worked actively to create a Great Serbia which would incorporate Bosnia and certain other provinces of the Dual Monarchy and leave a truncated Croatia to defend itself against Italian rapacity. But the Croats pressed for the union which was declared on December 1, 1918, under the joint auspices of the King of Serbia and the National Council of Slovenes, Croats, and Serbs in Zagreb. Under the stipulations of the Declaration of Union, a provisional National Assembly was created to legislate until elections could be held for a Constituent Assembly which would enact a Constitution for the state.

Several Ministries tried to deal with the national question. Protić tried to induce the Radicals to seek a solution of the growing Serb-Croat antagonism through a negotiated compromise with Croat federalists. The Democratic dominated Governments under Davidović and Pribičević followed a policy of no concessions to the Croats and thus increased the popularity of those Croat groups most distrustful of Serbia's good intentions. Elections for the Constituent Assembly returned almost an equal number of Radicals and Democrats to parliament and in Croatia-Slavonia brought Radic and his Croat Republican Peasant Party to power. However the 50 Croat Peasant deputies boycotted the Constituent Assembly giving the Radical-Democratic Government under Pašić a bare majority of those present. This made possible the enactment of the Vidov Dan Constitution that was opposed by most non-Serbian groups in the country. Shortly afterwards the Government passed the Law for the Protection of Public Security which provided the legal instrument for Serbian domination of the state.

In the elections of 1923 the Radicals received the backing of the majority of the Serbs while the Croatian Republican Peasant Party emerged from the balloting as the representative of an overwhelming majority of the Croat people. This indicates that a decisive cleavage had developed between the Serbs and the Croats less than five years after the proclamation of Jugoslav union.

Although both Serbs and Croats share responsibility for the bitter national rivalry that absorbed the energies of the people in a fruitless and sterile conflict, the Belgrade regimes were the most at fault since they alone had the power to unite the Serbs, Croats, and Slovenes or drive them assunder. 505 pages. $6.45. Mic 57-3202

JUDGE THOMAS BURKE: SATRAP TO THE EMPIRE BUILDER. A BIOGRAPHY.

(Publication No. 22,180)

Robert Carrington Nesbit, Ph.D.
University of Washington, 1957

This is a biography of Judge Thomas Burke of Seattle, Washington. It is based primarily upon his personal papers which are in the University of Washington Library. Thomas Burke came to Seattle in 1875 as a young man of twenty-six; having passed the bar examination in Michigan in the previous year. Seattle had been founded less than a quarter of a century before. The Judge was active in the city's economic development and political affairs until his death in 1925.

Seattle, in 1875, was a sawmill village on Puget Sound numbering a few hundred people. Burke saw it grow from a straggling village to a metropolitan center with a population of a third of a million which dominated the trade of the North Pacific. He was intimately associated with that growth and the establishment of Seattle's metropolitan hegemony on Puget Sound.

Seattle's early years before 1890 were characterized by a struggle with Tacoma for dominance in which Tacoma was aided by the Northern Pacific. The railroad management controlled the Tacoma townsite and worked to further Tacoma's advantage. Burke was involved in several promotions of local railroads intended to give Seattle access to the interior in competition with Portland and Tacoma. One, the Seattle, Lake Shore and Eastern, attracted outside capital and built over 100 miles of railroad although it failed to make any significant connections for the city.

In 1890, Burke accepted a retainer from James J. Hill and negotiated the Great Northern's entry into Seattle. This event firmly established Seattle's supremacy on the Sound.

A leading spokesman for outside money, Burke was active in attracting investment and speculative capital to Seattle and to Washington generally. He worked effectively for a congenial political climate for foreign capital and argued successfully for franchises, rights of way, and other corporate privileges. He served interests other than the railroads.

Burke accumulated a modest fortune through real estate operations in Seattle. He looked upon his role as that of a middle man to bring large opportunities and large aggregations of absentee capital together. He took his profit from peripheral schemes and an intimate knowledge of local real estate.

This biography offers a study of an individual urban pioneer who mirrors the aspirations and accomplishments of Seattle's business community during the city's youth.

708 pages. $8.95. Mic 57-3203

THE OFFICIAL ATTITUDE OF THE ROMAN CATHOLIC HIERARCHY IN GERMANY TOWARD NATIONAL SOCIALISM 1933-1945

(Publication No. 22,097)

David Charles Riede, Ph.D.
State University of Iowa, 1957

Chairman: Associate Professor N. V. Riasanovsky

The purpose of this dissertation is to investigate the pastorals, letters and sermons which relate to National Socialism, of the Roman Catholic hierarchy in Germany in an attempt to determine the official position which the hierarchy assumed toward the party and its philosophy. A brief survey of the political and religious situation of the nation in the early thirties is given to aid in understanding more fully the confused picture at the onset of the Nazi period and the Catholic participation in aiding the party to assume control of the German government.

As the years passed, and the amoral attitudes and pagan foundations of National Socialism were openly declared and understood, the hierarchy increasingly opposed the party with every means at its command. The Nazis, realizing the power of the Catholic Church in Germany, sought to destroy it by resorting to such measures as closing Catholic schools, prohibiting Catholic youth organizations, suspending publication of Catholic newspapers, etc., and replacing them with Nazi substitutes. The party even sought to replace Christianity with the pagan worship of historic German national gods, and finally by endeavoring to make the party itself the religion of the state.

An early attempt to reach an agreement which would alleviate misunderstandings concerning the relationship between Church and state was the Concordat of 1933. This document, however, failed in its purpose even though it was signed by both parties. Each accused the other in later years of violating the agreement and, as the years passed the struggle increased and became more intense. The Concordat deteriorated to be of almost no value even though the hierarchy continued until the end of the war its attempts to persuade the government to abide by the provisions of the agreement.

Due to the extensive destruction of the German nation in the final months of the war, few of the wartime pronouncements of the hierarchy can be found in their original form. Hence it has been necessary to rely upon the press releases of the National Catholic Welfare Conference Press Department in Washington, D. C., and the New York Times for much of this information. These two groups covered, as completely as was possible during the war, the religious struggle inside Germany. There are also two German books, Kölner Aktenstücke by W. Corsten and Kreuz und Hakenkreuz by J. Neuhäusler, which contain many of the pastorals, letters and sermons of the cardinals and bishops in the early years and which provide much material necessary in presenting the complete picture.

A chronological rather than topical approach has been followed in the hope that it will assist the reader in a better understanding of the various problems as they arose and the attempts which the hierarchy made to combat them.

A complete and comprehensive study of the problem cannot be made at this time since all the documents and letters are not available. However there is enough evidence in existence to show the attitudes and problems present and the trend of the struggle of the Church against Nazi moral perversion and degeneration.

From the evidence presented in the study it becomes apparent that the Catholic Church in Germany, as represented by the hierarchy, was not sympathetic with the National Socialists and consistently fought them through every means at its disposal. Although the voice of the hierarchy was severely curtailed through the intensive Nazi campaign to annihilate the Church, the historic soundness of unity and faith of the Christian people of Germany persevered through their years of persecution to see the defeat of their persecutors.

665 pages. $8.45. Mic 57-3204

THE DEMOCRATIC PARTY OF IOWA 1850-1860

(Publication No. 22,099)

Morton Mervin Rosenberg, Ph.D.
State University of Iowa, 1957

Chairman: Professor Allan G. Bogue

Settlers from the Southern states constituted the most significant portion of Iowa's population during the early period of her history, and, consequently, Iowans consistently voted Democratic in state and national elections. The national crisis over the vexatious slavery controversy provided Iowa Democrats with a popular campaign issue, the Compromise of 1850, which they successfully exploited in 1850 and 1852.

Although the Iowa Democracy triumphed easily during the early years of the 1850's, evidence of party discord manifested itself in northern and central Iowa. In Dubuque supporters of George W. Jones quarreled bitterly with Thomas S. Wilson and his followers. Democrats of central Iowa split with their political brethren over conflicting railroad projects as railroad mania gripped the state. And the question of internal improvements also provoked strife within Democratic ranks.

In 1854 a coalition of splinter groups, including Free Soilers, Whigs, abolitionists, anti-Nebraskaites, and temperance advocates, elevated James Grimes to the gubernatorial office over his Democratic opponent. Grimes profited from Democratic schism and anti-Nebraska prejudice, as well as from demands for homesteads, constitutional revision, internal improvements, and prohibition.

The middle years of the final pre-Civil War decade witnessed a series of significant developments which

profoundly altered the political complexion of Iowa. The dissolution of the Whig party of Iowa during 1852-1854 produced a power vacuum opposite the Democracy. The Know-Nothing party sought unsuccessfully to fill the gap by appealing to Iowans with a platform expressing anti-slavery sentiment together with nativist and anti-Catholic convictions. In 1856 James Grimes was the chief architect of the Republican party of Iowa which drew its support from former Whigs and Know-Nothings, Free Soilers and abolitionists, and anti-Nebraskaites and temperance men. The latter embraced the Republican organization largely because of Democratic hostility to the prohibition Act of 1855. Republicans also expected to win recruits among the new immigrants who swarmed into Iowa in great number from New England, the Middle Atlantic states, and Ohio by appealing to their anti-slavery impulses. Congressional approval of the Iowa land grant in 1856 further contributed to the Republican cause as the party obscured the role of the Democracy in the passage of the gift of land for the state.

Between 1856 and 1859 Iowa Republicans, capitalizing on Democratic schism fostered by conflicting railroad schemes, internal improvements, temperance, Nebraska, and Lecompton, swept the local and national elections in the state. The adoption of a new state constitution in 1857 as well as the unrest in Kansas aided the Republican cause.

Both wings of the Iowa Democracy managed to lay aside their mutual grievances to unite behind Augustus C. Dodge in 1859. But despite a determined effort to unseat the Republicans, Iowa's Democrats again failed to regain the gubernatorial and other state posts.

With the disruption of the national Democracy in 1860, the cleavage within the Iowa party re-opened as Jones-Breckinridge Democrats battled Douglasites, Republicans, and Constitutional Unionists. Lincoln and the Republicans carried Iowa with unaccustomed ease amid the wreckage of their demoralized opposition.

The Democratic party of Iowa toppled from its lofty position of power as a result of the interplay of several factors: the failure of the national organization to respond to the demands of Iowans for internal improvements, homesteads, and land grants; the skillful employment by Republicans of several local and national issues to attract the splinter groups as well as a large bloc of the state's foreign-born voters; the persistent feuding and rancorous feelings within the local Democratic party. The defeat of the Iowa Democracy was largely self-inflicted.

529 pages. $6.75. Mic 57-3205

WILLIAM SMITH, CHIEF JUSTICE OF NEW YORK AND QUEBEC, 1728-1793

(Publication No. 22,479)

Leslie Francis Stokes Upton, Ph.D.
University of Minnesota, 1957

The career of William Smith has been sadly neglected by historians who have thereby passed over one of the most influential of provincial politicians in the era of the American Revolution. As a councilor of New York colony he played a leading part in the Livingston family faction's feud with the De Lancey party. He opposed the extension of parliamentary power over the colonies in point of taxation and was prominent in opposition to the Stamp Act. Having established a reputation as a radical, he found himself courted by the Sons of Liberty when revolution approached in 1774. Smith suggested the policy that led to the calling of the first Congress, yet he was unable to sympathise with demands for independence, which he felt to be not only unnecessary but evil and ruinous. By profession a lawyer, his training had endowed him with a profound respect for British government and tradition. His successful legal practice had made him one of the wealthiest men in the province with a vested interest in preserving society as it was. When New York City was threatened with assault early in 1776, he moved with his family to their summer home at Haverstraw on the Hudson River.

An Olympian detachment from the conflicts of the day was impossible. Smith's negative attitude roused the suspicions of the revolutionary leaders of the state, and he was paroled to stay within the limits of the Manor of Livingston. He eventually returned to New York City in 1778, when it was under British control. After encountering initial reserve, he was accepted into the official hierarchy and appointed Chief Justice. He was persistent in his advice on how the war should be fought, advocating frequent punitive raids, combined with offers of leniency to induce waverers to come over to the British side. The commander-in-chief, Sir Henry Clinton, entrusted him with a large share in the abortive negotiations carried on with Vermont in an attempt to win the allegiance of the Green Mountain state. Smith was highly critical of the British conduct of the war, and considered that the acceptance of American independence represented a betrayal of the large majority of the colonials.

At the end of 1783 Smith took ship for England in the company of Sir Guy Carleton, last British commander-in-chief in the American war. The Chief Justice had found a man who agreed with his views and from then on his life and fortunes were bound up with Carleton. Smith was appointed Chief Justice of Quebec at Carleton's insistence and returned to the American continent late in 1786. He then hoped to establish a strong empire in North America which would serve as an inducement to the revolutionaries to return to their old allegiance, or at least guarantee England against the intervention of the United States in any future European war. Smith retained his close connection with Sir Guy, now Lord Dorchester, and was his principal adviser on the question of the future form that the government of Canada should take. The ideas which Smith presented in favor of a unified government were founded on those he had originally drawn up with reference to the seaboard colonies, for since 1757 he had been a proponent of a parliamentary type of government which would have given all the British provinces in America virtual autonomy under the Crown. In these ideas Smith predicted the shape that dominion government was to take in the nineteenth century.

405 pages. $5.20. Mic 57-3206

DECISION-MAKING IN RELATION TO THE PERFORMANCE OF HOUSEHOLD ACTIVITIES IN NEW YORK STATE HOMES

(Publication No. 22,197)

Mildred Jean Davis, Ph.D.
Cornell University, 1957

This study was a preliminary examination of procedures families use in making day-to-day decisions; most influential factors in decision-making; relative importance placed on resources; number of alternatives considered; and satisfaction with decisions.

Decision-making in relation to the performance of household activities was studied in fifty-nine families in Schuyler County, New York in 1956. Homemakers kept a diary record of some of their household activity decisions for one week. An interview was then held with the homemaker and her husband.

Homemakers reported information on 410 household decisions. The highest numbers were in the areas of care of the house, 74; food preparation, 71; and washing, 49. Activities alternate to the one performed were considered in 96 of the 410 decisions. The problem of when to do an activity was considered in 146 of the 410 decisions by 51 homemakers. Whether or not to do an activity entered into 124 decisions of 45 homemakers.

Homemakers saw more than two alternatives in 11 per cent of the decisions. It would not be feasible for the homemaker to devote time to consideration of several alternatives to decisions of this magnitude.

Time was the key factor in shopping, dishwashing, washing, ironing, and gardening and care of the yard decisions. Provision of material goods and services was the prominent factor in decisions concerning food preparation, food preservation, sewing, and community activities. Standards was the conspicuous factor in care of the house and upkeep of the house. The factor of money was the most important in the buying and people were the most important in the leisure activity decisions.

Approximately four-fifths, 332, of all decisions reported were evaluated as being completely satisfactory.

The homemaker participated in all decisions reported and was the sole participant in 65 per cent of them. Husbands participated in 18 per cent, daughters in 13 per cent and sons in 8 per cent. The greatest amount of participation was found in leisure, buying, and upkeep of the house. The highest proportions of decisions made by the homemaker alone were in washing, ironing, and care of the house.

Children began entering actively into decision-making at the age of five years.

During the interview homemakers and husbands were asked to describe themselves as decision-makers in general. From their descriptions, persons were classified as decisive, deliberate, or indecisive decision-makers.

Decisive decision-makers were characterized by ability to make decisions easily when they had the facts and by having the answer present itself clearly to them. They acted upon their hunches and trusted their judgment. None of this group avoided decision-making. Their decisions tended to be final once made.

One-fourth of the deliberate decision-makers pointed out that although they were deliberate in making decisions in general, they were decisive in making day-to-day decisions. They tended to rate themselves as fair, but the only persons who rated themselves as good were in this group.

Indecisive decision-makers kept changing their minds about the right answer to the decision. They liked to think about the possible results of the choices. One-fourth of them mentioned wanting to avoid decision-making. They seldom mentioned satisfaction with decisions made. They tended to rate themselves as poor decision-makers. They had less formal education than the other two groups.

A similar analysis of larger decisions made by the family would seem to be valuable. The effectiveness of the diary method as a teaching tool for use in the classroom or in working directly with families in helping persons to become more aware of the decision-making process could be tested. 170 pages. $2.25. Mic 57-3207

A STUDY OF CERTAIN ASPECTS OF DISCOLORATION IN POTATOES AFTER COOKING

(Publication No. 22,367)

Mercedes Lenore Hunsader, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Flora Hanning

In cognizance of the demand for potatoes that cook white in color, there was a need to investigate the effect of holding various varieties of potatoes at room temperature for different lengths of time following cold storage, and to study the effect of various dips and sprays, including a synthetic chelating agent, on the discoloration in potatoes which develops after cooking.

This investigation included the following comparisons: (1) the change in mean color scores with the changes in time that potatoes were held at room temperature, (2) the differences in the phenol and iron content in the juice pressed from the light and dark areas of raw and cooked potato tissue, and (3) the amount of iron in the residue from these areas. The method of Rosenblatt and Peluso was used for the phenol determinations; the Saywell and Cunningham procedure for the iron determinations.

In order to accentuate the effect of certain additives on the phenols and iron of potato tissue, composites of potato slices were evacuated in solutions of benzoic, boric, caffeic, chlorogenic, tannic and citric acids, di-sodium

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

ethylene diamine tetra acetate or EDTA, and iron sulfate. These comparisons and those of the interrelationship of the iron and phenols in the juice and iron in the residue, as well as the ultra-violet absorbance of the juice and tissue extracts, were studied in relation to the causative agents of blue-black discoloration in potatoes.

The mean color scores of a judges' panel identified different samples of potatoes but not varieties of potatoes. The effect of holding potatoes at room temperature for various lengths of time varied with the sample. In the samples which showed very little or a very large amount of discoloration, when taken directly from cold storage, holding them at room temperature had an insignificant effect; in the two samples which showed a borderline acceptability, the color scores decreased significantly with three weeks room temperature storage. In general, a significant change indicated a decrease in mean color scores with storage at room temperature.

There was no effect of the various sprays on the color scores of Ontario potatoes. The sprays that were used over a two year period included sodium and iron salts of EDTA and iron sulfate. Calcium and magnesium salts of EDTA and sodium citrate were used as sprays for one year with the same result. Sodium EDTA was not effective as an intact tuber dip, but sodium citrate was. It produced more potatoes of an acceptable color, and caused the iron to be equalized throughout the light and dark areas of the tissue.

The sprays and dips had no effect on the phenols or iron of the light and dark areas, except for sodium citrate, as stated above, and EDTA when sprayed late in the growing season. However, the dark areas caused more phenols and more iron to be released into the juice pressed from it. The iron determinations on the residue fell in a wide range. The only additive to the potato slices that had a major effect was citric acid.

A comparison of phenol concentration, absorbance and mean color scores with a variation in the storage of potatoes at room temperature showed a close relationship, with an indication that phenols are the principal component of the discoloring pigment. It was not possible to identify the phenol or phenols by comparison with absorbance data from tyrosine, caffeic, and chlorogenic acids.

136 pages. $2.00. Mic 57-3208

A STUDY OF FACTORS AFFECTING FINANCIAL SECURITY IN A GROUP OF INDIANA FARM FAMILIES

(Publication No. 22,300)

Alice Camilla Stubbs, Ph.D.
Purdue University, 1957

Major Professor: Cleo Fitzsimmons

This is a study of factors affecting farm family financial security. The data were gathered from a random sample of farm families in eight central Indiana counties. To be eligible, families had to consist of husband and wife and could include any other members dependent on the family income.

The purposes of the study were to obtain information regarding: (1) the extent of farm family financial security, (2) factors characterizing families evidencing financial security, and (3) ways of predicting farm family financial security.

Information obtained dealt with several phases of family financial management as well as characteristics of the family, the farm, the home, and the family's attitudes toward selected financial situations. Financial management factors included: amount of present indebtedness, purposes for which credit was used, types of investment, types of insurance held by the family, amount paid annually in insurance premiums, ways of meeting emergency expenses, consumption costs for seven classes of consumption goods, provisions made for old age, and amount of net worth inherited.

Data were obtained on net worth, income, and value of home produce consumed in a year. Remmers' House and Home Scale was used to classify families by socio-economic scores.

A classification was set up for each of the nine financial management factors and for the four sociological factors: education of the family head, education of the wife, family goals, and participation in community activities. Percentages of families in each division of these classifications were found. Tests for significance of relationships were run on selected groups of the percentages. In each case the tests were made in the classes containing the highest percentages. Tests were not made when the frequency number was very small.

The amount of present indebtedness was related significantly to stage in the family life cycle, age of the family head, net worth and low income. Type of investment was related significantly to extreme groups in stage of the family cycle and net worth classifications. It was related to income only in the test between low and middle income. Provisions for old age showed a significant relationship to net worth. Tests made on other management factors did not indicate significant relationships with other factors considered.

For purposes of analysis families were asked to evaluate their ability to attain goals, meet consumption costs, and present economic conditions. It was found that stage in the family life cycle, age of the family head, net worth, income, ways of meeting emergency expenses, and tenure have a relation to the percentage of families reporting they would be able to attain goals, meet consumption costs, and to percentage reporting they are satisfied with present economic conditions.

In a third analysis correlation coefficients were obtained for 17 independent variables with the dependent variable "financial security". For these selected variables arrangement by classes of each in a progressive or regressive order related to economic advantage was possible.

Among these 17 independent variables correlation coefficients large enough to indicate a dependable relationship to financial security were obtained for three: (1) ways of meeting emergency expenses, (2) ability to meet consumption costs, (3) net worth. For three others correlation coefficients large enough to suggest there might be a relationship to financial security were obtained: (1) amount of present indebtedness, (2) income, (3) type of provisions made for old age. Further study might clarify this relationship.

Net worth was found to be related to financial security

in each of the three analyses. Ways of meeting emergency expenses were important in two of the analyses. Amount of present indebtedness, income and type of provisions for old age were strongly indicated in two of the analyses to have a relationship to financial security. Ability to meet consumption costs was a factor on which information was obtained in one analysis. A correlation coefficient was obtained for it. In each case a strong relationship to financial security was indicated.

Three factors have been found that may indicate family financial security when it is postulated as a dichotomous situation while recognizing at all times that, in a sense, security may have many levels. These are:

1. Ways of meeting emergency expenses
2. Ability to meet consumption costs
3. Net worth.

Three other factors are strongly indicated as indicators of family financial security and the results suggest the desirability of further study to establish their relationship. These are:

1. Amount of present indebtedness
2. Income
3. Type of provision made for old age.

Other factors studied indicate important relationships to financial management but the relationship to financial security depends on their influence on the other variables which have a more direct effect.

252 pages. $3.25. Mic 57-3209

JOURNALISM

AN EXPERIMENT ON THE INFLUENCE OF PRESTIGE AND NATIONALITY ON OPINION CHANGE

(Publication No. 22,312)

John Berry Adams, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Ralph O. Nafziger

I. The Problem

It is generally agreed that statements made by a person of high prestige are more influential in opinion change than are statements made by persons of low prestige.

A question arose regarding the validity of this assertion in situations where the persons:

A. Were of different nationality
B. Made statements in agreement and in disagreement.

Prior study indicated that reference group, in terms of nationality, would be influential in opinion change in cases where the communicators disagreed.

This study was made to determine the relative influence on opinion change of prestige, reference group, and conditions of agreement in statements made in a mass communication medium.

II. The Method

Tests were devised covering the topic of nationalism versus internationalism. Thirty factual questions and fifteen opinion questions were asked.

The tests were given to 550 University of Wisconsin students. After taking the tests, the students read "news stories" purportedly taken from the New York Times. The stories answered some of the factual questions and contained statements on one side or the other of the opinion questions. Following the stories, the students took the same tests again.

The answers to the factual questions were the same for all students, but the opinion statements varied.

Sixteen combinations of prestige, reference groups, and agreement conditions were possible where personalities were involved. The variables were:

Prestige - High, Low
Reference Group - America, Britain
Agreement - Agreement, Disagreement
Side Advocated - Nationalism, Internationalism

In addition, four combinations were possible with unidentified spokesmen. Finally, four combinations were possible when either the unidentified American or unidentified Briton spoke for one side or the other.

Thus, there were twenty-four combinations. Packets of materials were assembled matching the combinations described above, and the packets were distributed randomly to students assembled in a lecture hall. Those subjects receiving materials containing a given combination became members of a given group. There were twenty-four groups, plus a control group.

Changes in answers to factual and opinion questions between the first and second test were scored.

III. Results

Analyses of variance showed no significant differences in opinion change at the 5 per cent level due to prestige or reference group conditions. Differences due to the agreement conditions were statistically significant at the 1 per cent level.

Subjects gained information. The differences between the first and second tests were statistically significant at the 1 per cent level.

Hypotheses were:

A. Statements made by persons of high prestige would tend to be more influential in opinion change than statements of persons of low prestige. Not confirmed.

B. Communicators in agreement would tend to be more influential than those in disagreement, regardless of the prestige or reference group of the communicators. Confirmed.

C. In cases of disagreement, opinion change would tend to be in the direction advocated by the member of the subjects' reference group regardless of prestige or the side he advocated. Not confirmed.

D. Subjects would tend to gain information regardless of the change or stability of their opinions. Confirmed.

IV. Conclusions

Under the conditions of the experiment, prestige and reference group conditions were less influential in opinion change than the conditions of agreement.

180 pages. $2.35. Mic 57-3210

PERCEIVED APPEALS OF TELEVISION PROGRAM CONTENT

(Publication No. 22,329)

Richard Fremont Carter, Ph.D.
The University of Wisconsin, 1957

Supervisor: Associate Professor Bruce H. Westley

This study tried to answer the question: What similarities are there among types of television program content in terms of their appeal to a sample audience?

A probability sample of 225 persons over 15 years old were asked to rate 76 types of television program content on a five-point ordered scale, ranging from "I Would Not Like It" to "I Would Like It Very Much". Scores of 1 to 5 were assigned these responses.

Similarity among content types was assessed by use of a factor analysis technique. Half, or 38, types were selected for analysis (randomly, from pairs matched on hypothesized similarity -- later checked and confirmed). Recent developments in factor analysis by Rao and Tucker suitable for high-speed electronic computers were used. (Programmed at Wisconsin for the IBM 650 by Harris and Peirce.)

Before factoring, the data matrix was corrected for known biases in the sample. A stratification technique removed effects due to audience characteristics of age, sex, and educational level. The "within" matrix remaining yielded nine factors, which after rotation were named as follows:

Category 1: General factor (of appeal).

Category 2: Information or entertainment which is removed from the day-to-day sphere of the prospective viewer, and which does not imply any active participation on the part of the prospective viewer.

Category 3: Information or entertainment which is close to the day-to-day sphere of the prospective viewer, and which does imply some participation on the part of the prospective viewer -- although not necessarily at the same time as the viewing.

Category 4: Content which is far removed in time or place from the prospective viewer, particularly when the presentation is dramatic.

Category 5: Sports entertainment, which includes such music and acts as usually occur at sporting events.

Category 6: Aesthetic entertainment, content which deals with classic themes.

Category 7: Pageantry or mundane, content which is glamorous versus content which is down-to-earth.

Category 8: Personal adjustment information (direct or indirect) versus non-personal "pictures" of the world, where "pictures" is not to be taken literally.

Category 9: Fun, particularly humorous entertainment.

Using the 38 unfactored content types and the 38 factored types, a reliability check was made on Categories 2 to 9. Reliability estimates, based on coder agreements with respect to assignment of content types to defined categories, varied from .55 to .96.

The nine categories were related among themselves as a result of the rotation procedure. A centroid solution of their intercorrelations disclosed three second-order factors, which were named:

Class 1: Generalized gratification versus particularized gratification.

Class 2: Content which is not person-oriented, and which tends to be external to the viewer's person versus content which is person-oriented and close or internal to the viewer's person.

Class 3: Content which stresses self-concern on the part of the viewer versus content which stresses non-concern.

Conclusions of the study were:

1. Based on a comparison with a similar factor analysis of the uncorrected data matrix, the stratification correction procedure yielded a "within" matrix which afforded quite different factor results. This suggests the utility of such a correction procedure where known biases in the sample exist; or, where it is desirable to extract significant but differential correlations of variables which occur as a function of some sample characteristic -- before seeking dimensions of response.

2. Potentially useful categories, with varying degrees of reliability, were found to parsimoniously describe the similarities of appeal among television program content types. These categories were found to appear in three larger classes of content.

202 pages. $2.65. Mic 57-3211

EMPLOYEE COMMUNICATIONS SURVEY FOR THE QUAKER OATS COMPANY

(Publication No. 22,108)

William B. Toran, Ph.D.
State University of Iowa, 1957

Chairman: Dr. Arthur M. Barnes

An employee communications survey was conducted at three plants of The Quaker Oats Company: Omaha, Nebraska; Sherman, Texas; and Cedar Rapids, Iowa. Purpose was to determine effects of the communications program upon employees. Employee attitudes toward the company and information about the company were examined. Reaction of employees to several media was analyzed. Three methods of communications were given special attention:

a. Employee participation campaigns, such as IGHAT (I'm Gonna Holler About Taxes), concerning government economy. Employees were encouraged to write their congressmen and to secure participation of people in the community.

b. Plant newspapers. The Sherman plant paper, professionally edited, had been printed as a small tabloid. Just prior to the survey it was published as part of the local city newspaper. Cedar Rapids office personnel issued

an informal mimeographed newspaper. Omaha did not have a plant newspaper.

c. Wives' program. Mrs. Kay Metz, of the company's main office, conducted a series of programs for wives of employees. Of the survey plants, only Omaha had been included in this program. Although sessions dealt with subjects such as "Women of Influence," husbands' health, and cake decoration, main purpose of the program was to give wives a better understanding of the company.

Methodology

A standardized questionnaire was used. Some employees were interviewed and others filled out the questionnaire in groups. The survey was conducted at the plants during working hours.

At Omaha and Sherman all available employees were surveyed. At Cedar Rapids, where the universe numbered approximately 1,000, 400 were surveyed. The survey sample at Cedar Rapids and the interviewees at all three plants were drawn from payroll lists by the random, equal-interval method.

Of the total of 707 respondents in the survey, 305 were interviewees. The survey groups at the three plants were as follows:

	Interview	Questionnaires Filled out in Groups	Total
Omaha	39	36	75
Sherman	105	132	237
Cedar Rapids	161	234	395
3-Plant Totals	305	402	707

Findings

In brief the finding revealed that:

1a. Most employees had a favorable attitude toward the company.

1b. Most employees were not well informed on specific information about the company.

1c. Employees who were well informed did not necessarily have a favorable attitude; that is, there was no correlation between attitude and information. Because of the limited approach in the present study, need for further investigation on this subject was indicated.

2. Employees preferred the company magazine and plant newspaper, among media carrying company information. Cedar Rapids employees, however, preferred television as a medium for "news about your plant." A majority of Quakers felt the company should provide more information to the community, mainly through newspapers.

3. A majority of employees felt the campaigns were acceptable; however, a distinct negative reaction was also evident. Fewer than one-half the employees thought the company was really concerned with reduction of taxes of individuals.

4a. A majority of Sherman Quakers preferred the plant page in the city newspaper to a strictly internal publication.

4b. Both Cedar Rapids and Sherman gave their employee newspapers a high rating.

5. Most of the Omaha men whose wives took part in the wives' program approved of the program. A large proportion indicated that the program had produced beneficial results. 371 pages. $4.75. Mic 57-3212

LANGUAGE AND LITERATURE, GENERAL

LOUISIANA PROSE FICTION, 1870-1900

(Publication No. 22,074)

Robert Burton Bush, Ph.D.
State University of Iowa, 1957

Chairman: Professor John C. Gerber

The state of Louisiana and the city of New Orleans in particular became important areas to be exploited after the Civil War by local-color writers of fiction. From about 1870 to 1900 there flourished a group of writers whose chief concern was the depiction and interpretation of Louisiana life of the past and present. The works of five of these authors comprise a valuable body of fiction: George W. Cable, Grace King, Lafcadio Hearn, Kate Chopin, and Ruth McEnery Stuart. All five resided in the state for long periods of their lives, and except for Hearn, they wrote almost exclusively about the state.

Three strong currents of nineteenth century culture are discernible in the several styles of these authors and in their thought. One is the Protestant, Anglo-American tradition, seen especially in the work of Cable, Miss King, and Mrs. Stuart. A second is the Catholic, Creole tradition of New Orleans, particularly in its development of a sense of history since the early days of the settlement of the Louisiana territory. This is also important in Cable's development, in Miss King's and in Mrs. Chopin's. A third force is the fiction of nineteenth century France. Lafcadio Hearn's Chita follows in the early tradition of French romanticism; Kate Chopin's fiction is strongly conditioned by her reading of the later French realism, especially the work of de Maupassant.

The novels and short stories of these authors are concerned with many aspects of Louisiana life and history. The scope includes the Creoles (especially those of the period before the war), the Americans, the Acadians, and the Negroes. Historic periods covered are from the time of the Louisiana Purchase through the time of war, the Reconstruction, and after. Several memorable works were produced by these authors. Cable's The Grandissimes, one of the most powerful novels on the subject of caste, through symbolism and allegory calls for an attitude of Christian brotherhood between the races. Grace King's

The Pleasant Ways of St. Médard is one of the most poignant books in our literature to deal with the Reconstruction period. Kate Chopin's novel The Awakening is an American Madame Bovary, a bold novel for its time and not yet fully appreciated. The short stories of Ruth McEnery Stuart give us one of our earliest genuine interpretations of Negro life in the South.

The most influential mind of this group is Cable, whose Old Creole Days was a major force in the revival of Southern letters after the war. He challenged the restrictions put on the writer by the Old South and prepared the ground for the critical frankness of the Southern writers of the present century. He is himself the best example of the Southern mind "liberated" by the Emancipation Proclamation. Before the war the Southern writer could not describe his own environment with frankness because of the pressure to defend slavery; when slavery was abolished a truer interpretation of life in the South could be made.

In depicting that life the Southern local-colorists did much to cement together the recently divided country by interpreting the South to the North. Southern local-color fiction was sponsored by such Northern magazines as Scribner's (later Century), which followed a policy of promoting good feeling between the two sections. The North provided a large reading public with a curiosity about Southern life; the South produced the fiction with the attitude of its authors that they were contributing to a national literature. 381 pages. $4.90. Mic 57-3213

A CRITICAL STUDY OF THE LYRICS OF RICHARD ROLLE

(Publication No. 22,141)

Rev. Blaise Hettich, O.S.B., Ph.D.
University of Notre Dame, 1957

The purpose of this study is to assist a reader of Middle English poetry in appreciating the lyrics of Richard Rolle. The poems analyzed are the dozen lyrics edited by Hope Emily Allen in English Writings of Richard Rolle (Oxford, 1931). These poems speak of the intimate relationship between a holy soul and Christ, sometimes in the form of advice to a beginner in the religious life, sometimes as descriptions of personal experience or of the contemplative life in general, sometimes in ardent prayers to Jesus.

This study employs the historical method along with techniques of the new criticism. The rhetorical analysis combines modern critical norms with those of the Middle Ages. The procedure involves seven steps which have led to the following conclusions:

1. By the time Richard Rolle wrote his English lyrics (c. 1343), he had matured as a writer and as a spiritual director.
2. Rolle's intention in writing these poems was to provide meditation material for his disciples' private devotions.
3. The thoughts and emotions contained in Rolle's verses are valuable as expressions of a genuine and sublime human experience.
4. The structure of these lyrics is based chiefly on a rhetorical development through devices of amplification.
5. The imagery is appropriate and sometimes striking. Images of heat, sweetness, and song are most frequent.
6. Most of the lyrics are written in four-line stanzas of rhymed septenaries. Their rhythm and tone suit the meditative or exhortatory character of each poem.
7. Considered individually, these lyrics stand up well under close scrutiny. Detailed analysis points up the value and success of each poem. Considered as a group, however, they are limited in theme, tone, and imagery, to the point of being repetitious. But they were never intended to be read together, and it is only by a slow and prayerful reading of each poem by itself that they can be justly appreciated.

Appendix I contains a transcription of Rolle's Canticum Amoris, never before published. Appendix II compares the lyric "Luf es lyf" to corresponding passages in the Incendium Amoris to show that the English poem was written before the Latin treatise, rather than vice-versa, as has been supposed by most scholars.

290 pages. $3.75. Mic 57-3214

THE COSMIC VOYAGE AND THE DOCTRINE OF INHABITED WORLDS IN NINETEENTH-CENTURY ENGLISH LITERATURE

(Publication No. 22,050)

Mark Robert Hillegas, Ph.D.
Columbia University, 1957

In the nineteenth century major transformations took place in the use of the idea of other inhabited worlds in serious discussions and in fiction. Under the impact of tremendous scientific and technological progress, the chiefly religious and philosophical doctrine of a plurality of worlds gave way after the Whewell-Brewster controversy of 1854-1855 to the modern, exclusively scientific examination of the problem of life elsewhere in the universe. Greater knowledge of the physical conditions of the celestial bodies and the widening gulf between science and theology were largely responsible for this change.

A similar transformation occurred in the cosmic voyage or imaginary journey to another inhabited world. As early as 1827 scientific and technological plausibility began to replace the fantasy which had characterized the cosmic voyage from the seventeenth to the early nineteenth century, and, by the time of Jules Verne's From the Earth to the Moon, the modern story of space travel had been born. Although the spirit of the cosmic voyage changed completely, many conventions of the journey through space established in the seventeenth century were continued in nineteenth-century stories.

Three factors brought about the change to realism in the cosmic voyage: the invention of the balloon, the advent of descriptive and sidereal astronomy, and the new prestige given to science by spectacular advances in technology. The new realism manifested itself in increasingly elaborate attention to the details of the space vehicle and its means of propulsion and to the description of the nature of space and the worlds on which voyagers landed.

The form of the cosmic voyage most frequently employed from the seventeenth to the middle nineteenth century, the journey to the moon, declined in popularity in the

last years of the century -- our barren, airless satellite was hardly a suitable subject for the ultra-realistic cosmic voyages written after 1880. Mars became the favorite destination of space travelers because of the great public interest in the planet aroused by Schiaparelli's discovery of the canals in 1877. In the last two decades of the century more than a dozen romances appeared which were based on the theory that Mars, a planet far advanced beyond the earth in its evolutionary history, had inhabitants scientifically, technologically, and socially superior to terrestrial men. In addition, ideas related to those which inspired the Martian romances were the basis of several stories about Jupiter and Venus as primitive worlds younger than our earth.

The new realism also appeared in the nineteenth century in two important variations on the cosmic voyage. The extremely popular underground voyage, which had developed from the journey to a world in space during the seventeenth and eighteenth centuries, changed from unrestrained imaginativeness to plausibility while continuing to demonstrate its kinship with the story of space travel. The voyage to the world in another dimension, a variation which first appeared in the eighteen eighties, was less obviously related to the familiar forms of the cosmic voyage.

The work which climaxed the process of transformation in the cosmic voyage in the nineteenth century was H. G. Wells's The First Men in the Moon. Its combination of new realism, artistic excellence, and the conventions of both the underground journey and the lunar voyage made it the finest cosmic voyage written since the eighteenth century. 273 pages. $3.55. Mic 57-3215

DICKENS' PERIODICAL ESSAYS AND THEIR RELATIONSHIPS TO THE NOVELS

(Publication No. 22,495)

Robert Charles Rathburn, Ph.D.
University of Minnesota, 1957

This study concerns the historical, thematic, and stylistic relationships between Dickens' periodical essays and his novels. The essays stressed are those detached papers which he wrote for his own journals, Household Words and All the Year Round; the Sketches by Boz and articles written for other periodicals are included whenever they provide additional apt illustrations of Dickens' opinions or style.

The study aims at correcting the common judgment that Dickens in his journal articles merely echoed the reformism of his novels. Furthermore, it shows that the journalistic element in Dickens' fiction, often criticized, is actually a great asset. From the realistic basis of court cases, reportorial journeys to Yorkshire schools, and night walks with the Metropolitan Police, Dickens drew material for romantic fiction which nonetheless remained highly realistic.

The opening chapter sets forth the method of quasi-quantitative analysis used. The following three chapters review Dickens' career as reporter, novelist, and editor. Special emphasis is laid on the journalistic strain in his work; illuminating examples of how facts given in articles became fictionized in the novels are presented. The chapter on Dickens as editor stresses that Dickens did not "return" to journalism via the founding of Household Words; it charts his editorial career from the editorship of Bentley's Miscellany, through the attempts to satisfy his journalistic bent by the brief editorship of the Daily News and occasional contributions to the Examiner and other periodicals, to his successful editorship of his own two journals during the last twenty years of his life.

Three chapters of exhaustive analysis of his journalistic and fictional handling of three themes follow. The chapter on the treatment of the law and the one on politics and government show that Dickens' articles in Household Words and All the Year Round are strongly consistent with views expressed on those subjects in earlier and current novels. The comparison demonstrates that Dickens' opinions, when stripped of their dramatic impact in, say, Bleak House or Little Dorrit, are as negative as those in the novels; however, the articles are weakly sarcastic in contrast to the impressive satire of the fiction. The chapter on Dickens' varying treatment of the theme of crime and punishment demonstrates that the essays give positive views about prisons and criminals not to be found in the novels. A reader of the novels alone may suppose that Dickens sympathized with the criminal, because a criminal character sometimes takes on a quasi-heroic role. The essays make clear that Dickens was no sentimentalist: he favored a firm system of punishment for violent offenders and gloried in the efficiency of the reformed police.

The concluding chapter summarizes the comparisons possible with other broad topics of both novel and essay: the poor and charity, education, religion, nationalism, and the theatre and the arts. In the case of charity, for instance, Dickens satirized charitable institutions in the novels but editorially approved of certain charities. In the novels, Dickens gave negative pictures of the kinds of schools that he disapproved of, but in the essays he showed what kind of education he favored. In both exposition and fiction, Dickens tended to be against insularity when at home and the typical British traveller when abroad.

In addition, the concluding chapter draws together general ideas about Dickens' opinions and his methods of writing. His over-all consistency of opinion is weighed against his sometimes serious inconsistencies. The effect of editorial writing upon the style of the later novels is shown. Finally, Dickens took realistic, journalistic detail of the kind displayed clearly in the essays and so used it in his fiction as to create our myth of Victorian England. 635 pages. $8.05. Mic 57-3216

ELIZABETH MADOX ROBERTS: HER SYMBOLISM AND PHILOSOPHIC PERSPECTIVE

(Publication No. 21,745)

Earl Herbert Rovit, Ph.D.
Boston University Graduate School, 1957

Major Professor: Professor Edward Wagenknecht

The work of Elizabeth Madox Roberts, Kentucky novelist and poet (1881-1941), presents a problem in valuation. Her early novels, particularly The Time of Man (1926) and

The Great Meadow (1930), received critical acclaim and popular success. Yet today Miss Roberts' novels are virtually neglected or given scant recognition as "regionalist." Examination shows that "regionalism" in the 1920's and 1930's was primarily a sociological phenomenon; the term "literary regionalist" proves to have little objective critical meaning, operating rather as a vaguely pejorative label. Accordingly, I examine Miss Roberts' work in terms of three questions: What does she try to accomplish? How well does she succeed? Is the achievement worthwhile?

By studying her published works and her extensive private writings, it is possible to extract her philosophic and aesthetic perspectives. The intellectual profile which emerges is that of a philosophical idealist whose basis of faith is in an active perceiving imagining mind; her definition of reality is highly subjective, organic and dynamic. The primal unit is the self-contained experiential individual, striving to grow in accordance with the principles of organic harmony -- that is to say, self-urged to become true, beautiful, and good by the natural accretions of experience. Further, this isolated individual can transcend himself, merging into something beyond himself through love, friendship, communal groupings, and aesthetic and religious experiences. In these flashes of transcendent "belongingness," individuality is not lost, but, paradoxically, greatly intensified. Happiness consists then in the most expansive outward-thrusting of the individual -- the most extensive creation of design on the chaos of sensation.

Aesthetically Miss Roberts regarded art as a legitimate way toward self-realization. Accordingly her novels are fashioned to provide a stimulus for the self-realization of her readers. Her literary method of "symbolism working through poetic realism" attempts to make the reader participate in the artistic creation of reality, and her characteristic stylistic and narrative techniques are functional to this purpose. Her use of an evolving subjective reflecting consciousness and a fluid implicational style emphasize the level of "spirit" in her novels; the important question for her is never, What happened? but, What meaning does it have?

Her seven novels effectively carry out these purposes. They are love stories in which the protagonists achieve an intensified sense of self without narcissism. In each novel the protagonist successfully creates an organic life-pattern of harmonious relationships out of the materials which life offers him. In a sense, each protagonist is portrayed as an artist engaged in an unending attempt to attain form in the media of experience. On a more universal level, the dogged gropings of the individual characters are seen as representative of humanity in epic conflict with man's fate. In her best novels, Miss Roberts depicts this struggle without sentimentality, pessimism, or naive optimism. The Time of Man, The Great Meadow, My Heart and My Flesh (1927), and He Sent Forth a Raven (1935) persuasively affirm the victory of the creative spirit of man over the forces of time, chance and death. In He Sent Forth a Raven especially, Miss Roberts deals directly with the agony of our time, sketching out the difficult but possible way toward hope in a seemingly hostile universe.

Miss Roberts writes within the stream of the American tradition of Emerson, Whitman, and Emily Dickinson. Like them she is socially a democratic individualist, a philosophic humanist, and an artistic transcendentalist. She is also deeply aware of the contemporary revolutions in art and philosophy. She is a modern thinker, a modern artist -- a novelist too long neglected on the American scene.

380 pages. $4.85. Mic 57-3217

LESLIE STEPHEN, MAN OF LETTERS AND CRITIC OF LITERATURE

(Publication No. 20,889)

Edwin Drummond Sheen, Ph.D.
University of Illinois, 1957

This study, which involves a broader investigation of Stephen's writings in all fields than has hitherto been attempted, is designed to furnish materials for a reconsideration of his merits as a critic rather than to account definitively for the decline of his reputation during the first half of the present century.

In line with Stephen's own convictions about the close relationship between a man and his book preliminary attention is given to the influences which touched him for better or worse in childhood and youth, to a survey of his varied career as a man of letters, and to a summary of the basic principles which guided him in the formation of his opinions. The three most significant roots nurturing his general philosophy were the evangelical religion as propagated by the "Clapham Sect," which he accepted on trust in his formative years and repudiated in form only as he reached maturity; the rationalistic bias of Cambridge University, with which he associated his coming of age and to which he remained loyal throughout the rest of his life; and the empiricism of the new science, popularized through the activity of Charles Darwin and his followers, which suggested a reasonably objective method of dealing with speculative matters.

Stephen's "stumble" into criticism, as he termed it, occurred while he was a reviewer of current books and a writer of "rubbish" on miscellaneous subjects for the Saturday Review and the Pall Mall Gazette--some time, that is, before he attracted attention as editor of the Cornhill Magazine and composers of "Hours in a Library" and other occasional articles on writers and writing. Though he avoided aestheticism, he was not entirely unwilling or unable to discourse on questions of beauty and style and taste. Basically a journalistic critic himself, he advocated the scientific approach as a wholesome discipline for the prosaic members of his craft, carefully distinguishing them from the rare critical genius who could leap intuitively to the right conclusions without the aid of "instruments."

Basically a child of the eighteenth century (though not unsympathetic towards a reasonable admixture of romantic sentiment and enthusiasm), he welcomed literature and criticism which respected order, decorum, and good sense; and he disparaged criticism which was founded upon untested opinion or which gushed and shrieked uncritically about popular idols, ancient or modern. He also accepted the eighteenth-century doctrine that literature should teach as well as delight, attaching particular importance to the moral lesson which he regarded as inevitable. He was thoroughly annoyed, however, by lessons of any sort taught directly and "of malice prepense."

Some attention is given in the final chapter to recent

discussion of Stephen's criticism, the general conclusion being that since there is an antithetical opposition between his ideas and those of the "New Criticism," he is peculiarly subject to misinterpretation when judged by modern standards.

Appended to the main body of this study is an account of the excursion into bibliography which the survey of Stephen's writings necessarily entailed; and a Stephen Bibliography which includes several hundred of his hitherto unrecognized contributions to the Saturday Review and the Cornhill Magazine, as well as some other pieces to which he attached his name but which possibly have not been noted previously because they were published obscurely.

745 pages. $9.45. Mic 57-3218

LANGUAGE AND LITERATURE, CLASSICAL

A FORMAL ANALYSIS OF THE VOCABULARIES OF AESCHYLUS, SOPHOCLES AND EURIPIDES

(Publication No. 22,445)

Dorothy Madsen Clay, Ph.D.
University of Minnesota, 1957

This dissertation presents a descriptive morphemic analysis of the vocabularies of Aeschylus, Sophocles and Euripides. The entire emphasis is placed on the word-formational features of Greek Tragedy, and, although semantics has been a criterion in classifying the three vocabularies, this is not a semantic study.

The Introduction states the problem and its history and explains the method of analysis and classification. Part I is the Analysis and Commentary, and Part II consists of Classified Lists and Concluding Summary. These two parts are arranged in parallel-numbered sections for easy cross-reference. The method of analysis is purely descriptive, historical explanations being entirely omitted. The basis of comparison among the three authors is statistical, and since this type of analysis is used here for the first time, only a few comparative figures for other authors are available.

The vocabulary (14448 different words) is first classified into two major categories: derived words and underived words. In the derived category the parts of speech (form classes) are distinguished, viz. nouns, adjectives, pronouns; adverbs, interjections; verbs. Within each of these form classes the analysis follows the same sequence: first of all the suffixed words, then compounds, finally a section on 'zero change'. Each numbered paragraph in Part I contains the following information for each section: bibliography, statistics, word-stem (i.e. underlying source of the derived word), and general remarks. Statistical summaries of each subsection are placed after the appropriate sections.

In Part II (Classified Lists) is found the entirety of the vocabularies of the three Tragedians, listed in reverse alphabetical order (except words under the headings Derivation by Change in Form Class, and Proper Names). Compound Nouns, Adjectives, Adverbs and Verbs are each given in two arrangements: reversed and normal alphabetization.

The Concluding Summary contains the percentage figures, based on the total number of different words, which illustrate the density of specific derivational areas and form classes in each author.

Because of the gross bulk of the work an exhaustive analysis of the material is not attempted. The main task is to account for the three authors' vocabularies, to comment on the morphological categories, and to contrast frequency in the three authors. The system of analysis and classification used here will provide a basis for statistical comparison of any other Greek text with Tragedy. While the analysis is here limited to three authors, the whole treatment is intended also as a basis for the restudy and reclassification of the entire field of Ancient Greek habits of word-formation.

482 pages. $6.15. Mic 57-3219

LANGUAGE AND LITERATURE, LINGUISTICS

GE- AS A PREVERB IN LATE OLD ENGLISH PROSE: ITS MEANING AND FUNCTION AS SUGGESTED BY A COLLATION OF WEST-SAXON, MERCIAN, AND NORTHUMBRIAN VERSIONS OF THE GOSPEL ACCORDING TO SAINT MATTHEW

(Publication No. 22,385)

John William Richard Lindemann, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Frederic G. Cassidy

This dissertation examines the use of the OE preverb ge- in the light of evidence provided by a collation of three Late OE versions of the Gospel of Saint Matthew in order to ascertain to what extent such evidence does or does not support conventional opinions concerning the functions of this preverb.

Part I reviews all of the previous dissertations, essays, and articles pertaining to ge- that research in connection with this investigation was able to bring to light, and presents a brief summary of the observations that each of the writers of these works has to make on the significance of the preverb to him.

Part II consists of an analysis of the corpus itself, a corpus composed of the West-Saxon, Mercian, and Lindisfarne versions of the Gospel of Saint Matthew as found in the 1887 edition of this gospel by the Reverend Walter W. Skeat. The material is broken down into two lists, List A and List B.

List A presents all of the Latin compounds in one column and the readings of each of the manuscripts in separate columns parallel to it. It is followed by a statistical analysis and by comments which, to the author, seemed to be relevant interpretations of the data.

List B presents all of the Latin simplexes and the corresponding verbs in OE that translate these simplexes. The OE verbs are in each instance given in context, at least to the extent of a sentence constituent. List B is then also followed by an analytical discussion of the apparent relationship of OE ge- compounds to the Latin simplexes.

In both of the analyses of these lists, every instance of every verb in the corpus is recorded, and in his attempt to determine the apparent semantic value of the preverb, the writer deliberately refrains from discussing the OE compounds in terms of the "Aktionsarten."

Part III presents the conclusions that the data of the study appear to suggest. These data suggest that the significance of the preverb was lexical rather than syntactical, that "perfectivation" is a matter of meaning rather than of form alone, as Martens and Streitberg would have had us believe, and that its lexical value may have approximated 'out, forth', and 'to' rather than 'with', or, as A. F. Pott suggested almost a hundred years ago, "Hinweg." 460 pages. $5.85. Mic 57-3220

THE INFLECTION AND SYNTAX OF MARANAO VERBS

(Publication No. 22,204)

Howard Paul McKaughan, Ph.D.
Cornell University, 1957

Maranao is a Philippine language spoken in the province of Lanao, and is a member of the Malayo-Polynesian family. It has four syntactic classes: substitutes, particles, nouns, and verbs. Substitutes are either inflected (personal pronouns) or non-inflected, and may replace constructions introduced by case marking particles. A particle never enters into immediate constituent (IC) arrangements with bound morphemes and never occurs as the center of any construction. There are non-relational and relational particles. The relational particles are coordinating, subordinating, and case marking. A noun is a content word which is uninflected and never occurs as a predication center. A verb is an inflected form which occurs as the center of a predication.

The major constructions in verbal predications are uncentered and centered. An uncentered construction is one in which the constitute does not have the general distribution of either of its IC's. One IC of such a construction is always a particle. The two types are those with subordinating particles as one IC, and those with case marking particles as one IC (substantive phrases). A centered construction is one in which the constitute occurs with the general distribution of at least one of its IC's. Such constructions are either double or single. Double centered constructions are coordinate or appositive, and include a coordinating particle which links the IC's. Single centered constructions have either noun or verb centers. A noun centered construction may have a non-relational particle, a substantive phrase, or a substitute as its attributive. A verb centered construction may have a non-relational particle, an uncentered construction, or a substitute as its attributive.

Certain inflectional morphemes built into the verb mark the syntactic relations between verb and topic (substantive phrase introduced by particle so). These are labeled voice markers. Voice inflection also indicates the possible sequences of other substantive phrases that may occur attributive to the verb center. The voice markers and thus predication types are subjective marked by √ma- indicating that the topic originates the action, objective marked by √-en indicating that the topic is the goal of the action, instrumental marked by √i- indicating that the topic is the means used in performing the action, and referential marked by √-an indicating that the topic is the beneficiary of the action.

There are four inflectional categories included in all verbs. These are voice, mode, aspect, and tense. Voice is treated in the syntactic discussion. There are two modes: indicative marked by the absence of voice/mode markers indicating non-obligation or indicative action, and obligatory marked by voice/mode morphemes -i and -a indicating obligation or necessary condition. The five aspects are general marked by the absence of other aspect morphemes and indicating that none of the other aspects are in view; aptative marked by √ka- indicating possibility or capability; distributive marked by √paN- indicating that the action is distributed through time, among several people, or in several ways; causative marked by √pa- with ki- or ka- indicating that someone permits or causes an action to take place; and aptative-causative indicating a very polite way of requesting or describing an action. Four tenses are neutral marked by the absence of other tense morphemes, past marked by √-i-, immediate future marked by √e indicating certainty as well as futurity, and present progressive marked by √pe-.

Morphophonemic alternations are indicated by the Item and Arrangement model with illustrations set up in paradigmatic form. A summary of the relative order of inflectional affixes is given in both diagram and paradigmatic form.

Two texts are appended to illustrate verb inflection and syntax. 108 pages. $2.00. Mic 57-3221

LANGUAGE AND LITERATURE, MODERN

BOILEAU AND LONGINUS

(Publication No. 21,110)

Jules Brody, Ph.D.
Columbia University, 1956

The most significant contribution to Boileau studies of this century has been the destruction of the législateur du Parnasse legend. Because it appeared to explain so much this myth prospered long, and, in a way, its exposure posed more problems than it solved. This account which credited Boileau with having ordered the taste and practice of his age's most brilliant generation of writers, had given a convenient direction and unity to the movement of seventeenth-century French literature, while, at the same time, providing its most celebrated critic with a function and influence commensurate with his reputation. But when it was shown that Boileau could not have schooled the grands classiques and, more important, that almost every point in his literary doctrine had been made by earlier critics, a great deal of re-shuffling had to be done. What to do with a monarch whose kingdom proves suddenly never to have existed?

This study has attempted to restore to Boileau the two qualities which critics unanimously deny him: originality and unity of thought. The demonstration of the first departed

from a fact, the second from an assumption. Practically speaking, it was Boileau who gave Longinus' Peri Hupsous to the world, and his interpretation of its purpose did enrich the critical tradition. The assumption which this study sought to test was once expressed by Pascal: "Tout auteur a un sens auquel tous les passages contraires s'accordent ou il n'a point de sens du tout." Is there in Boileau a psychological principle to which both his attraction to Longinus and his own critical position can be traced back?

The language of the Traité du sublime, as Boileau's earliest critical effort of any magnitude, offered a convenient measure both of the unity of his critical vocabulary and of the strength of his allegiance to Longinus. Faithful to Longinus' central notion of kairós, he viewed great writing as the fruit of a parfaite habitude, a savoir secret, an inscrutable principle of insight and control which in the body of his works he recapitulated in the word raison.

In Boileau's renderings of Longinus' descriptions of the effects of the Sublime, qualities of intensity, spontaneity, and enthrallment were foremost. The writer's power to cast a spell, create a gripping illusion, was magnified. Boileau did not have to forge a special vocabulary to translate the affective impact of the Sublime. Plaire, toucher, étonner, frapper, ravir, remuer, words which filled the pages of his works were equal to that task.

Longinus' Sublime, that inner essence which rivets the attention, was for Boileau not an incidental literary effect but "la souveraine perfection du discours." His concepts of genre and style, his insistence on naturalness and simplicity, his notion of Tragedy, and his manner of translating the Ancients all were calculated to conserve that perfection and to keep the emotive effects of literature undisturbed, intense and pure.

302 pages. $3.90. Mic 57-3222

THE INFLUENCE OF OTHELLO IN JACOBEAN AND CAROLINE DRAMA

(Publication No. 22,444)

Harriet Durkee Broeker, Ph.D.
University of Minnesota, 1957

Adviser: Huntington Brown

Othello offered to Shakespeare's successors useful and detachable scenes (particularly the temptation, brothel, and murder scenes), precedents for handling the token and eavesdropping conventions, the model of the Vice-Machiavel villain masquerading as malcontent-honest soldier, and the central example of extended treatment of the jealous husband as a tragic figure. Othello is a negligible influence on Dekker and Webster; in Middleton's tragedies, the material of temptation and jealousy is assimilated and transformed; Heywood borrows the Othello-temptation for isolated scenes. Markham and Machin's The Dumb Knight is the first play extensively indebted to Othello, borrowing the shifting motivation of the villain, the extended temptation scene, and the agonies of the jealous hero. Fletcher borrows the temptation pattern most extensively in Philaster, somewhat casually in other plays; more than most playwrights, he borrows in isolation other scenes and parts of scenes. Massinger characteristically borrows the individual scene, usually the temptation, and the character in the scene. In The Duke of Milan, Massinger adapts both plot and character to the Othello pattern of temptation and jealousy. Ford's borrowings are very extensive in two plays: in The Queen, he experiments with the Othello pattern in tragicomedy, adding to already-existing difficulties in character; in Love's Sacrifice, he follows the Othello temptation-jealousy sequence closely and more successfully; in 'Tis Pity, he uses the temptation and murder scenes, absorbing the material to his own dramatic purpose in a way similar to Middleton's. Davenant follows the Othello sequence of temptation and jealousy in Albovine and The Platonic Lovers, and uses the brothel and murder scenes in The Cruel Brother. Shirley seems less directly indebted to Othello than do the others, but he uses the now-established convention of the temptation scenes, though the scenes are seldom central, as they are in closer Othello-imitations. Of the minor Caroline playwrights, Carlell borrows the villain and the temptation in The Deserving Favorite; "J.D." in the Knave in Grain uses these elements and borrows a number of lines; Heminges in The Fatal Contract borrows many lines, parts of the temptation, and passages from the final scene; Rider in The Twins combines eavesdropping and temptation somewhat as Davenant had done; Glapthorne in Revenge for Honour borrows lines, the apparently honest villain, and the temptation. Ghismonda and Sampson's Vow-Breaker are heavily indebted verbally to Othello.

The nature of Othello-imitation points up the characteristically episodic construction of these plays. Apparent attempts to make the temptation and jealousy psychologically credible (a true or seemingly true charge against the lady, her suspicious behavior, a tendency toward emotionalism in the hero, the villain's more obvious motivation, a believable time-scheme, a previously close tempter-victim relationship) are upon examination far outweighed by additional improbabilities. Playwrights faced with the problem of retaining audience-sympathy for a wrongly-jealous husband found Shakespeare's solution through temptation most satisfactory; often even justifiably jealous husbands and honest informers are drawn on the Othello-Iago pattern in the scenes of temptation. The inciting and goading of jealousy are always more perfunctory in the imitations, none of which borrows Othello's single action. In the tragicomedies, where the hero survives, he is never blamed for believing his tempter; and in comparison to Othello's temptation, the others are less horrible, sustained, and convincing. Audience and playwright apparently accepted the temptation convention as a satisfactory and more dramatic substitute for psychological probability.

Appendix: The catalogue of verbal imitations indicates that the playwrights rarely borrowed lines from Othello in isolation from a generally parallel scene-situation.

349 pages. $4.50. Mic 57-3223

FRERON'S CRITICISM OF PROSE FICTION

(Publication No. 22,324)

Jean D. Bundy, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Joseph E. Tucker

From 1745 until his death in 1776, Elie-Catherine Fréron directed three periodicals: the Lettres de Madame la Comtesse de *** sur quelques écrits modernes (1745-46), the Lettres sur quelques écrits de ce temps (1749-54), and the Année littéraire (1754-76). These journals represent well over two hundred volumes of critical writing, and yet Fréron has been considered by scholars almost exclusively as an enemy of the philosophes. Little attention has been paid his role as a literary critic. The present study attempts to clarify Fréron's position through a study of his criticism of prose fiction. Such a study also provides further information on the changing critical attitude toward the novel in France during the eighteenth century.

Considering Fréron's general comments on the form, content, and techniques of the novel, as well as his criticism of individual authors, it can be seen that there was a definite development in his critical theory of the novel. Early in his career he relegated the novel to a minor position in the literary hierarchy. Gradually, as he recognized the increasing importance of the novel, he considered it more seriously, attempting to establish for it certain critical standards. Among the problems he was most concerned with in regard to the novel were its purpose, that is, whether it should be primarily entertaining, instructive, or both; suitable form and content; verisimilitude and the use of realistic detail; characterization; and style. Over the years his attitude changed, and as he continued to discuss the novel seriously, he approached a comparatively modern definition of it. In his criticism of specific novels, many of his comments remain valid today.

In addition to his views on the novel, the study reveals that Fréron's role as a comparatiste was of considerable significance. He was very much aware of the increasing interest in foreign literature, and there is little doubt that his periodicals did much to further that interest. In his journals, there are a great many foreign novels reviewed, most of them English. In these reviews, he displays a sound grasp of the major trends of the English novel of the eighteenth century.

Thus, through this study of Fréron's criticism of prose fiction, it becomes evident that his position as a critic was greater than has been thought by most of the scholars who have written about him. In addition, by watching the development of his ideas on the novel, the modern reader can trace the progress that was made by that genre in its attempts to establish itself in France during the eighteenth century. 323 pages. $4.15. Mic 57-3224

MELVILLE AND AUTHORITY: A STUDY OF THEMATIC UNITY

(Publication No. 22,222)

Nicholas Canaday, Jr., Ph.D.
The University of Florida, 1957

Melville's fiction proceeded from a long life spent in subordination to external authority. From the day he stepped aboard a merchantman until he left the custom house some fifty years later, Herman Melville felt the galling shackles of restraint. Seldom throughout the voyage of his life did he feel free to steer his own course -- to captain his own ship. Always a common sailor on shipboard, he experienced the harsh discipline of the sea. In the South Sea islands he jumped ship to escape the restricted life in the forecastle. These experiences forcibly taught him the lesson of the chain of authority. "Who ain't a slave?" asked Ishmael, and he answered, "However the old sea-captain may order me about . . . I have the satisfaction of knowing that it is all right, that everybody else is one way or another served in much the same way."

In the present study the term authority is used to mean the power, vested by the warrant of moral right or legal right in persons or groups, which coerces those subject to it in the spheres of action and belief. Authority cannot function -- although it may exist -- without power. Yet the two terms are not synonymous because the coerciveness of power may be merely physical and may operate without authority. The distinction lies in the fact that authority implies right. There is a latent ambiguity in the term right: it may mean "that which is warranted by moral approval" or "a power vested by law or custom." Because of this ambiguity, a differentiation is made between the vesting of authority by the warrant of moral right and legal right. This concept of authority as applied to four categories -- the authority of the state, the authority of the ship captain, the authority of God, and the authority of society -- comprises Melville's unifying theme.

This book tests the extent to which the theme of authority appears in the tales and the novels. Each work is examined in the order of original publication, so that it is possible to see the development of the theme and its ever-increasing importance as a structural framework upon which to display the materials Melville gleaned in his lifelong search for answers to man's deepest philosophical questions. The sailor-narrator in Melville's earliest novels -- Typee, Omoo, Mardi -- discovers that as a carefree rover in the South Pacific he escapes the restraints of European civilization. The authority of the ship captain becomes of central thematic concern in Redburn, White Jacket, and Benito Cereno. The cosmic significance of authority emerges in Moby-Dick, which demonstrates man's relationship to the will of God. Pierre and Bartleby are studies in the coercing power of society. The several aspects of the theme of authority coalesce in Melville's last novel. Billy Budd sums up the major thoughts and appears, more truly now than ever before, the artistic culmination of the intellectual labor of a lifetime. 319 pages. $4.10. Mic 57-3225

THE WINGS OF LOVE AND TWO STORIES

(Publication No. 22,075)

James Trammell Cox, Ph.D.
State University of Iowa, 1957

Chairman: Professor Paul Engle

If it were not true that for the creative writer an after-the-fact statement of purpose is invariably wiser than an announcement of intention, it would be with a certain sense of hypocrisy that the writer of these three pieces of fiction, "Carolina Gothic," "This is Sedlacek Talking," and "The Wings of Love" comes to the task of composing such a statement. For as Henry James's "germs" they possessed little that was apparently common, and no conscious effort in the writing of them went toward the kind of unity which would allow them to be grouped as they are here and discussed as pieces displaying any singleness of purpose. Yet it is now manifest, that these pieces have been written, if not with a single purpose, certainly a central concern. This concern is for the plight of the little man who is "not with it," whether the "it" be the realities of the funereal world of Gilbert Sasser in "Carolina Gothic," purveyor of the cosmetics and other preparations for the physical beautification and preservation of the dead, or of the Optimist world of Serge Sedlacek, hotel manager, or of the moral and emotional wasteland of John Howard Bond, the writer-teacher. Each is not with it. And to borrow further phraseology from Herbert Gold in The Man Who Was Not With It, each is too awed by the marko world of reality, which he cannot accept, ever to attempt an escape into the carnie world of rebellion or escape. His is consequently not either the carnie world or the marko world, but the limbo of emotional trimmers, leaning together in the cactus land. And in "Carolina Gothic," Gilbert Sasser is unable to rebell against his wife, whom he unconsciously blames for his life among the dead except by hallucination, whereby he projects his rage through the person of an escaped killer from the Criminally Insane Ward of the Cherry Point Marine Base Hospital. In "This is Sedlacek Talking," Serge Sedlacek, another little man, discovers his inadequacy as a hotel manager and has only the support of his equally inadequate and narcissistic wife to support his tenuous control over this world in which he does not belong. In "The Wings of Love," John Howard Bond, a writer and teacher, conceives a romantic attachment for his friend's wife under circumstances as unromantic as a planned exchange only to learn ultimately in his impotence that the source of both his idealization and of his impotence lies in an adolescent renunciation of life for art, to which he is now helplessly committed.

164 pages. $2.15. Mic 57-3226

THE IMAGERY OF SPENSER'S FAERIE QUEENE

(Publication No. 22,335)

Judith Dundas, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Merritt Y. Hughes

On what grounds has Spenser been called "a dream poet"? On what grounds has he been called "the painter of poets"? The purpose of this study is to identify the quality of the descriptive, or non-metaphorical, imagery in the Faerie Queene. The first four chapters, by examining the content of his imagery, attempt to account for its dreamlike quality. The last two chapters analyse the form of the imagery in order to account for its pictorial qualities. Thus this is a purely qualitative study and is in no way concerned with the mere counting of images; nor does it purport to be an exhaustive survey of every image in the poem.

The method consists of examining the imagery from a different point of view in every chapter. Chapter I discusses the Elizabethan attitude toward allegory for its bearing upon the traditionally recognized dream quality of the imagery; it is seen that the dream quality is itself expressive of the allegorical intention. Chapter II recognizes the stock character of the imagery, its conceptual, as distinct from perceptual, basis. Chapter III continues the discussion of the stock character of the imagery by showing that its implicit point of view is anthropocentric and that it is affective in intention. Chapter IV begins by considering the importance for allegory of giving moral judgments an affective basis; it then proceeds to assess the symbolic values of the imagery and concludes that these values are not simply allegorical, but properly dreamlike.

Chapter V turns to the pictorial construction of the imagery. Spenser's following of the doctrine of ut pictura poesis is discussed and illustrated by his use of the descriptive schemes of rhetoric. It is found that his use of these schemes is largely responsible for the picture-gallery effect of his poem. At the same time he is relieved of the charge that he interpreted ut pictura poesis to mean that poetry has no other end than the description of objects as a painter might depict them. Finally, Chapter VI tries to give a composite account of the imagery by showing that because of the fundamental tension between image and symbol, the poem is both a dream world and a tapestry. In the treatment of the decorative quality of the imagery, comparison is made with the characteristics of Renaissance paintings, so that in every respect Spenser appears as a typically Renaissance artist.

In the Conclusion his personal, and not his Renaissance, quality is emphasized and named as "contemplative", a word which suggests the ordered and dreamlike calm of his imagery. 220 pages. $2.85. Mic 57-3227

THE LITERARY ACHIEVEMENT OF CONSTANCE FENIMORE WOOLSON

(Publication No. 22,352)

Stella Clifford Gray, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor H. H. Clark

Miss Woolson's complete literary canon was last assessed in 1934; enough new material is now available, primarily in the Woolson Collection at Rollins College, to make a more detailed and sympathetic appraisal possible. Her work, published between 1870 and 1894, was widely read and highly praised by general readers and critics. Her friend Henry James was most impressed by the "high sense of the picturesque," the "high finish" in creating a "social atmosphere," and the "singularly and essentially conservative" spirit of her work. Her fame declined rapidly until today her work is almost forgotten. Why? Should it be revived?

This study examines in greater detail than ever before the formative factors, both personal and professional, contributing to her career--temperament, family tradition, religious and moral concepts, education, and travel; wide reading, literary codes, and techniques. Next her work is analyzed by type: essays and short stories, poetry, and novels. The general unfamiliarity with her work necessitated fuller description than would ordinarily be required. Thematic relationships are emphasized.

There emerges a woman of dramatic temperament, yet conservative in attitudes and habits, with keen powers of observation, an avid curiosity about people and places, an intense sympathy for people, and a wealth of personal courage, perseverance, and intellectual independence. She read widely in contemporary European and American literature, being most influenced by realism as practiced in her generation. She deemed herself a realist, recording her observations impartially. She thought literature should deal with the permanent values in human life and that plot should be a riddle of exciting adventure. Although realistic in intent, her work was also partly romantic; she consistently preferred to observe the unusual character, the little-known scene.

Her miscellaneous essays and travelogues hold little interest today but reflect the taste of her time. Her poetry is undistinguished, lacking imaginative power and originality of theme; though irregular and often rough, its form is more interesting than its conventional ideas. Her short stories of the American scene introduced her readers to the wild and remote areas around the Great Lakes, to tropical Florida and other Southern scenes--all places she knew herself. She is considered the first to describe adequately and sympathetically, yet without sentimentality, the post-war South. Her final stories with European settings are less vigorous, dealing principally with American expatriates, not local scene and populace. Many of the stories are social documents as well as entertaining fiction. Her novels employ the same settings, minutely detailed, against which is set the action of carefully analyzed characters. Her chief interest was always the character development of persons unhappy and frustrated in their search for fulfillment. Most notable are several noble heroines who renounce personal satisfaction for an ideal more important than self.

Her work is uneven, the excellent and the poor appearing indiscriminately throughout her career. When weak, her work is characterized by superfluous detail, superficial characterization, narrow range of interest, reliance on coincidence, unoriginality, sentimentality, and melodrama. When strong, it is marked by a sharp sense of humor, a wealth of carefully assimilated details, appealing characters, interesting action, artistic restraint, and significant themes.

If at first her work was evaluated too highly, it is now too much neglected because of a change in popular taste. Although it reflects the conservatism, class and race consciousness, and overrefined gentility of her personal heritage and of many of her generation, it has, at its best, lasting virtues worthy of study in its skillful presentation of interesting settings, social groups, and individual characters. 573 pages. $7.30. Mic 57-3228

JAMES FENIMORE COOPER'S ATTITUDE TOWARD ENGLAND

(Publication No. 22,358)

George Westebbe Hartung, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Harry H. Clark

This thesis is an examination of Cooper's changing attitudes toward the manners, customs, traditions, and institutions of the English people and of the relation of these attitudes to his literary development and political ideas.

Chapter I presents his early development as influenced by his family background, education, experiences as a sailor and naval officer, and the social and political milieu of New York of the early nineteenth century. Despite the Anglophile tradition of the Federalist "gentry" and the Loyalist sympathies of his wife's family, Cooper early in life exhibited a critical attitude toward England and became a Democrat largely because of the Federalist idolization of England.

Chapter II is an analysis of his early novels and critical writings to 1828. These reveal a conflict between Cooper's admiration for some features of the English social system and his espousal of American democratic ideals. He was critical of some American writers, particularly Washington Irving, because of their praise of England, yet in his novels of the American Revolution Loyalists are characterized sympathetically.

Cooper's views on the general characteristics of the English people are covered in Chapter III. He found England to be too materialistic. Although he accepted the dogmas of the Episcopal Church, he felt the Established Church was dominated by a "grasping, worldly spirit." The English people were, he concluded, "drilled . . . into coldness." They possessed "noble qualities," but rarely showed warm feelings; England was "a country that all respect, but few love."

In his criticism of the institutions and polity of England (Chapter IV) Cooper attempted to show that England offered no models for Americans. England, in Cooper's view, was dominated by the aristocracy; the king was no more than a figurehead. The peers of England, through

the corrupt electoral system, effectively controlled every phase of the government. The only democratic force operative in England was the steady pressure exerted upon their leaders by the most enlightened people in Europe. Cooper's conservatism is evident, however, in his rejection of the ideas of English reformers such as Robert Owen, William Huskisson, and William Cobbett.

Chapter V attempts to show that the major intellectual influences upon Cooper were English and that his efforts to aid in achieving what he called America's "mental independence" were vitiated by his adherence to certain features of English literary and social conventions. He believed that the literature of England and America would never differ in "taste and forms": "the only peculiarity that can, or ought to be expected in their [the Americans'] literature, is that which is connected with the promulgation of their distinctive political opinions." In accord with his political beliefs, he felt that Scott was dangerous for American readers because of his "deference for hereditary rank." Yet Cooper's acceptance of social castes and the literary conventions of the sentimental novel conflict with his efforts to write novels American in spirit. Leatherstocking exhibits this incongruity in his dual role as a symbol of frontier democracy and as the devoted servant of the Loyalist officer, Major Effingham.

Chapters VI and VII interpret the difference between Cooper's ideas of the relations between England and America and his acceptance of certain British practices as a result of the differences in his social and political ideals. Despite his patriotism and his belief that many Americans exhibited too servile an attitude toward England, Cooper regretted that America had departed from some English traditions. He is seen as a major spokesman for the English traditions of liberty through respect for established law, a propertied class with ideals of service and benevolence, and a morality based on traditional religion. 350 pages. $4.50. Mic 57-3229

THE POPE IN THE RING

(Publication No. 22,171)

Marjorie Ruth Henry, Ph.D.
University of Washington, 1957

Chapter I of this thesis attempts to show that Robert Browning's The Ring and the Book has been given a Victorian reading because of certain elements in its form and content, and because of some Victorian pre-concepts about Browning. It proposes a new reading of parts of the poem, especially the Book of the Pope. The poem, more than twenty-one thousand lines, is written in twelve books, ten of them being dramatic monologues. While critics have recognized this ring of monologues, somewhere in the middle of which lies Truth, they have failed to apply this principle of the form to an interpretation of the content. Book X, "The Pope," for example, has been looked on as representing the Truth, on both simple plot and symbolic levels. Yet the form of the whole poem, a ring of biased monologues, as well as the content of the poem, declares that each book represents only one facet of the diamond of Truth, even the Book of the Pope. A new interpretation of this book shows that the Pope, too, is a character in The Ring and the Book, that he is not just Browning's mouthpiece, and that he is a questioning, fallible old man.

Chapter II discusses in full the importance of the Victorian controversy of the infallibility of the Pope, made Catholic Church doctrine in 1870. Browning's poem was published in 1868-69, and the battle which had been raging for more than ten years over this church doctrine made a definite imprint on the poem. The Brownings were well aware of the Catholic revival of the nineteenth century, which received its impetus from the Oxford Movement in the 1830's and '40's and which culminated in the pronouncement of Papal infallibility. Further, the Brownings, living in Italy during the Italian struggle for independence, were bitterly disappointed in the part Pope Pius IX played in this effort. Innocent XII, Pope of Browning's poem, declares throughout his monologue that he is fallible man rather than infallible Pope; and he figuratively strips himself of his Papal robes before pronouncing judgment on the murder case before him, which is the subject of the poem.

Chapter III gives evidence that Browning's use of the term Molinism and its proponent Molinos was a deliberate part of the structure of the poem, which helped to characterize the Pope as fallible. Molinism, and the analagous heresies of Jansen and Fénelon, are referred to thirty-five times in the poem, each book but one having one or more uses. When it is understood that Molinos was a religious heretic, and that all references to him by others than the Pope are hostile, the significance begins to pyramid. The Pope's references to Molinos are friendly; yet a fulfillment of Protestant-like Molinism would mean the extinction of the Catholic Church.

Chapter IV shows the Pope emerging as an uncertain old man, as uncertain about his religion as his decision to condemn Guido. The Ring and the Book becomes again a ring of monologues, each illustrating partial truth. And Fra Celestino's sad and pessimistic conclusion that "All men are liars and only God is true" cannot be explained away as critics have endeavored to do. Browning's first metaphor of men as part shine, part shade becomes the symbolic key to the larger metaphor of the ring and the book.

Because the intent of this thesis has been to give the Pope his proper role in the poem and to place him back in the ring of prejudiced speakers, this study is called "The Pope in The Ring." 257 pages. $3.35. Mic 57-3230

A STUDY OF THE MEDIEVAL ENGLISH POEMS RELATING THE DESTRUCTION OF TROY

(Publication No. 22,363)

Norman Dexter Hinton, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Helen C. White

Poems treating of the siege of Troy form the third largest group of works dealing with a single theme written in medieval England. Since the Trojans were thought the ancestors of the British, these poems treat a subject very important then. Yet they have never been studied for their literary merit, though the general history and outlines

of the story have been treated. I have investigated each poem separately, for its relation to the tradition and its intrinsic artistic worth.

The tradition begins with two Latin works of the early Christian era by "Dares Phrygius" and "Dictys Cretensis", who pretend to be eye-witnesses of the siege. Both contradict Homer. These psuedo-histories were believed true in the Middle Ages. They came into England mainly through the Latin prose version of Guido delle Colonne, who adapted the Old French poem of Benoit de Saint-Maure.

The earliest Troy poem written in England, c. 1184, is Josephus Iscanus' De Bello Troiano, a Latin epic in six books, adapted from Dares. It is written in good Silver Latin style, in accordance with the precepts of rhetoricians of Joseph's time. This work, which displays compassion with suffering and sorrow at men's recklessness, has been overlooked too long.

The Seege of Troye exists in three fourteenth-century versions and one fifteenth, known as L, E, A, and H. The four versions differ in artistic merit. Version L was found to have a tight, well-organized plot, opposing not only two armies but two supernaturally endowed champions whose fate is to meet at Troy. The A version does away with the supernatural, thus losing much force, and destroying the balance of the plot. The H-version attempts to turn the tale into a romance, and fails.

The Laud Troy Book and the Gest Historiale of the Destruction of Troye are also fourteenth-century works, both from Guido. The first of these begins as a romance of Hector, but breaks down when he dies midway through the tale. The writer is concerned throughout with courtly ethics. The Gest, an alliterative poem, enhances the retelling of history with the author's considerable rhetorical resources. It succeeds until the end, where the Greeks' adventures on the way home are recounted in flat, uninspired verse.

There is no denying that Lydgate's Troy-Book was proved to have all the faults critics find in him: defective meter, lack of structure, and rambling, prosaic, statement. The poem, written for Henry V, is a courtesy book and a moral sermon on the duties of kings. It is the worst poem of the lot.

I found that elements unessential to the story began to accumulate in the later poems. These I have called "romantic", because they involve matters which are treated in the romances -- interest in rich clothes, armour, music, feasting, and courtly behavior. These elements finally detract from the story line, by their richness, taking emphasis off action.

Only De Bello Troiano and Seege-L succeed completely; the main reason the others fail is a mistaken devotion to history, which forced the poets to abandon whatever original plans they had for ordering their material, so they could tell the whole story. However, Gest, though a failure finally, was found worth reading, because of the author's feeling for words and his ability to maintain the structure of his verse until the end. The Troy poems, ignored for so long, produced three works worth inclusion in the canon of better medieval literature, and all are interesting examples of the problem medieval authors faced with the task of making history into art.

300 pages. $3.85. Mic 57-3231

THE WORK OF BERNARD DEVOTO: INTRODUCTION AND ANNOTATED CHECK LIST

(Publication No. 22,088)

Robert Edson Lee, Ph.D.
State University of Iowa, 1957

Chairman: Professor Alexander C. Kern

This dissertation is constructed around its lengthy appendix: a chronological listing and annotation of over eight hundred books, stories, articles, and book reviews by Bernard DeVoto. The introduction orders and discusses these writings on the basis of three categories: fiction, non-fiction, and areas of work. Preceding these is a brief sketch of DeVoto's life (1897-1955) with emphasis on the contrast between his early years in Utah, "child of an apostate Catholic and an apostate Mormon," and the later years in Cambridge, Massachusetts. Certain unpublished manuscripts, Harvard sketches and two complete novels dated 1918-1922, are discussed here for the first time to indicate the nature of his apprenticeship.

DeVoto's fiction included five serious novels, six "slick" serials and fifty short stories. The novels -- The Crooked Mile (1924), The Chariot of Fire (1926), The House of Sun-Goes-Down (1928), We Accept With Pleasure (1934), and Mountain Time (1947) -- are shown to be competent regional studies, but less successful as living works of fiction.

DeVoto's articles are grouped first on the basis of original publication, chiefly in Harper's Magazine, The Saturday Review of Literature, and Woman's Day, but also in some thirty other periodicals. The best are the 243 essays, "The Easy Chair," a unique social record of a twenty year period and a literary contribution to the art of the personal essay. The Year of Decision: 1846 (1943), Across the Wide Missouri (1947), and The Course of Empire (1952) are discussed as a trilogy, aspects of a central theme, "continentalism." They are works of synthesis rather than original research, ordered for literary purposes; they use techniques of fiction to make the past come alive; they represent a "new realism" to point up the true significance of the West and to correct earlier romantic illusions about the frontier.

DeVoto's work is then regrouped into nine major areas. Writings on the West are reviewed to show the dominating influence of a sequence: Utah, the revolt from the village, Mormonism, Utopias, the frontier, sectionalism, and an East-West tension; these provide both a bias and a special enhancement to much of DeVoto's work. His articles on Education are treated as examples of malicious satire. Mark Twain's America (1932) and Mark Twain at Work (1942) are detailed with emphasis on the Brooks-DeVoto controversy, and DeVoto's pioneer investigations of the influence of the frontier on Twain and his probings for the sources of Twain's pessimism. The Literary Fallacy (1944) is outlined and discussed pro and con as an important contribution to literary history. The World of Fiction (1950) is presented to show the influence of Freud and the development of the theory of fiction as phantasy. Brief comment is made on the possible influence of Vilfredo Pareto on DeVoto's ideas of historiography. The political writings are reviewed to show DeVoto's stand as a "liberal democrat." The Strange Fruit case and the attack on the F.B.I. are detailed to show DeVoto's peripheral

concern for civil liberties. His conservation articles and lobbying activities are discussed to show how the obligation to the West dominated his life to its end.

Novelist, essayist, editor, literary critic, historian, reporter, and teacher, this was Bernard DeVoto. A concluding chapter points out the value in the study of American Civilization of the broad approach, the search for a usable past, and the healthy skepticism in the work of a man who was "a dissenter, a heretic, and a minority."

352 pages. $4.50. Mic 57-3232

JOHN ADDINGTON SYMONDS: NINETEENTH-CENTURY HISTORIAN OF THE ITALIAN RENAISSANCE

(Publication No. 22,465)

Mary Jane Loso, Ph.D.
University of Minnesota, 1957

This study deals with Symonds as a late nineteenth-century historian of the Italian Renaissance. A literary critic, biographer, translator, essayist, and poet, Symonds is remembered in the twentieth century primarily for his seven-volume history of the Renaissance in Italy. Symonds' attitude toward the problems of his own age and his solution of his personal difficulties help to explain the philosophy of history and the method of historiography which mark the Renaissance in Italy as the product of the man and his time.

Highly educated, acutely sensitive to the social, intellectual, and religious changes occurring in late nineteenth-century England, Symonds touched the century at many points. After years of intense emotional and intellectual distress, he arrived at belief in an immanent deity and stoic-epicurean acceptance as a possible creed and guide to conduct in his transition age. With unwavering confidence he placed his hopes for mankind's future progress in democracy and science.

Inevitably Symonds drew upon rationalist, romantic, and scientific contributions to a philosophy of history which encouraged emphasis upon history as the evolution or progressive development of mankind. Like many of his contemporaries, Symonds found in past eras of civilization both comfort and inspiration. He participated therefore in the nineteenth-century revivals of interest in Greek antiquity and the English and Italian Renaissance. He came to look upon history as three stages of development: the Hellenic era, the source of modern civilization; the medieval era, a stagnant period dominated by the Church and feudalism; and the modern era, upon the first part of which, the Renaissance, he concentrated much of his attention.

In the same eclectic manner, Symonds drew upon the romantic and scientific methods of historiography, formulating a standard of historiography by which he attempted to guide his writing of the Renaissance in Italy. He strove to write scientific history, a Kulturgeschichte of the Renaissance in Italy. Nevertheless, habits acquired in his work as a literary popularizer, long familiarity with the aesthetic and humanistic aspects of the Renaissance, the appeal of the colorful personalities of the Renaissance period, and firm convictions regarding the necessary line of progress toward the future militated against his success in writing scientific history or Kulturgeschichte. The history suffers from excessive bulkiness, disproportion, unevenness of style, inaccuracies, and the failure to present a complcte or unified account of the Italian Renaissance. It is instead a handbook to the fine arts of the Italian Renaissance; an abbreviated account of the development of humanism; a critical discussion of Italian literature from its origins through the sixteenth century.

Preeminently the Renaissance in Italy presented a polemic for the modern spirit and a conception of the Renaissance which has lingered into the twentieth century. Symonds saw the period as a time of transition from the retrogressive middle ages to the progressive modern age, a time of radical intellectual and social changes. More insistently than his predecessors, he stressed the role of the Renaissance in the liberation of mankind from medieval shackles, evaluating humanism, the arts, and literature for their contribution to this emancipation. He accepted, consequently, all phases of Renaissance civilization, admirable or unadmirable, which furthered man's discovery of himself and his world, and condemned any forces which hindered such progress. Behind the brilliant personalities, the anomalies, and the feverish activity in the Renaissance he saw a saving message for modern men. The Renaissance made possible the growth of science and democracy. Renaissance, Reformation, and Revolution were successive acts in the drama of liberty, the drama in which nineteenth-century men were still participating.

311 pages. $4.00. Mic 57-3233

THE DEVIL AND THOMAS HARDY: A STUDY OF THE MANIFESTATIONS OF SUPERNATURAL EVIL IN HARDY'S FICTION

(Publication No. 20,873)

Thomas Oliver Mallory, Jr., Ph.D.
University of Illinois, 1957

In this study of the manifestations of supernatural evil in the fiction of Thomas Hardy, the first step is a demonstration of the full extent of Hardy's use of the diabolic. Specific works are analyzed, and the material is classified according to the three traditional modes of demonic manifestation: diabolic incarnation, sorcery, and possession. The attempt is made to show the moral, metaphysical significance of the diabolic in the stories in which the symbolism is found. Particular attention is given to dominant and recurrent patterns in the portrayal of the characters and the development of plots in which supernatural evil is manifested. Finally, these analyses are concerned with the instances in which Hardy's intentions regarding the use of the diabolic were opposed by other motives and the instances in which his accomplishments show a marked divergence from his conscious intentions and intellectual formulations.

Two of Hardy's characterizations merit special consideration as attempted creations of incarnate devils. The Devil is very nearly realized in "The Romantic Adventures of a Milkmaid," and the irresistible lover of "The Fiddler of the Reels" is almost supernatural enough to qualify as a minor demon. The rest of Hardy's devil-like characters are near-devils, that is, undeniably human

villains who nevertheless demonstrate supernatural attributes and appear to be substitutes for the Devil. Such near-devils are found in Desperate Remedies, The Hand of Ethelberta, and A Laodicean.

Of sorcery there are clear instances in Under the Greenwood Tree, A Pair of Blue Eyes, The Return of the Native, and The Woodlanders. Vilbert, in Jude the Obscure, is a partly realized sorcerer.

Though the evidence indicates that Hardy was never completely conscious of portraying a character as a victim of demonic possession, four of his characters can be explained in terms of possession with more clarity and consistency than are offered by other explanations. Troy, in Far from the Madding Crowd, and Diggory, in The Return of the Native, are presented as human agents of a power which uses them to work evil beyond or even contrary to their intentions, and the hints of the supernatural in the characterizations suggest that the power is in effect the Devil.

In two stories possession is a central theme. Henchard, in The Mayor of Casterbridge, is an elaborate portrayal of a man driven by an inner demonic force to his own destruction. The Mayor is Hardy's most successful use of the manifestations of supernatural evil in a harmonious and metaphysically sound development of a major characterization. A similar success in the short story is his portrayal of Rhoda Brook, in "The Withered Arm," as a victim of demonic possession.

The first conclusion to emerge from this study is that in his fiction Hardy made use of the manifestations of supernatural evil to an extent not generally recognized in literary criticism. Second, this material has a demonstrable metaphysical significance in that it implies a reasonably consistent interpretation of the mystery of evil. Third, use of such material was necessary to Hardy for psychological, philosophical, and artistic reasons. Finally, it is clear that Hardy was not fully conscious of the supernaturalism implied in this considerable portion of his fiction. The sum of the evidence points to the theory that Hardy's developing self-consciousness as an artist, resulting in a more thoroughly conscious control of his material, eventually sealed off the most fruitful sources of his art as a novelist. 207 pages. $2.70. Mic 57-3234

THE THEME OF DIVINE ORDER AS SEEN IN THE LIFE AND WORKS OF KARL HEINRICH WAGGERL

(Publication No. 21,743)

John J. Mulligan, Ph.D.
Boston University Graduate School, 1957

Major Professor: Professor Waldo C. Peebles

This study, which is devoted to an investigation of the life and works of Karl Heinrich Waggerl, commences with an examination of the author's life and proceeds to a comprehensive discussion of the essential elements which form and condition Waggerl's Weltanschauung, which is based upon his concept of Divine Order. Like Friedrich Griese and Richard Billinger, Waggerl is classified as a "Heimatdichter."

The man's life falls naturally into four determining periods which I have treated under the headings: childhood and boyhood; youth and World War I; the difficult years; and the period from the novel Brot to the present time.

The main point of departure of Waggerl's works is a conception of an order founded on a supernatural level. This all-encompassing postulate is clarified through an interpretation and analysis of its elements within the ideal nature of the field and the real nature of the village world, with projections into the entire realm of humanity. Three well-defined stages of his development illustrate this theme. The function of the vagabond or tramp, the role of the woman, and the problem of village and city give impetus and personalization to this aspect of the study. The "Dorfmensch," as a human being seeks a full life through a "Divine Order - Real Nature - Ruhe" formula.

The illegitimate child appears in a sufficiently important role to merit analysis. It has its function within the village world and possesses a potential for development to attain a life of fulfilment.

Humor courses its way through the works of Waggerl. Investigation and interpretation of his humor produce relationships between humor and the following facets of his thinking: social criticism; comfort; the indestructibility of man; evil; the ideal nature of the field; and philosophical observations concerned with mankind, with woman as woman, and with the author himself as a celebrity and as a human being.

The multitude and the sameness in kind of Waggerl's hobbies reveal an active sympathy for the elements which work within his concept of Divine Order. A study of the relationship between objectivity and his writing is included herein.

Waggerl's critical works provide a formulation of his own concept of literature and his mission as an author. Thus, literature, to Waggerl, is the simple expression of the sacred power to reveal the immutable forces of God in the realistic terms of life and the world as a source of comfort for all humanity in its unceasing strivings to attain eternal "Ruhe." The writer is a tool in the hand of God to carry out this mandate.

The particular mandate and requirements of a Catholic writer make it possible to judge Waggerl in this light.

I interpret the Weltanschauung of Karl Heinrich Waggerl as a recognition of the Divine Order of this world, created by a kind and just God, who has established the fundamental structure of the fulfilled life as a means for man to experience a reflection of the eternal peace and comfort of the beatific vision. It is no less the sacred duty of the artist to recognize and accomplish his mission as a mediator between God and man.

282 pages. $3.65. Mic 57-3235

PATTERNS OF IMAGERY IN THE MAJOR PLAYS OF TENNESSEE WILLIAMS

(Publication No. 21,954)

Nancy Marie Patterson, Ph.D.
University of Arkansas, 1957

Major Professor: Albert Howard Carter

The purpose of this paper is to determine the dominating patterns of imagery in the major plays of Tennessee Williams published between 1940 and 1955. In this analysis, I explore his figurative language through the patterns of symbolism and imagery that lead, in turn, to the meanings.

In this procedure, the term symbol applies to the visual object which has an explicit or implicit relationship to an idea or person in the story. The term image includes these symbols and verbal comparisons.

The method by which I explore these patterns is through an analysis of: (1) setting, (2) character, (3) action and story. The major plays form the main basis for the exploration, especially in the first two areas, setting and character (Battle of Angels, 1945; The Glass Menagerie, 1945; You Touched Me!--with Donald Windham--1947; A Streetcar Named Desire, 1947; Summer and Smoke, 1948; The Rose Tattoo, 1951; Camino Real, 1953; Cat on a Hot Tin Roof, 1955).

The pattern of the settings reveals that Tennessee Williams frequently uses expressionistic devices to mirror, accentuate, or attenuate the emotions on the stage. The colors, the division into levels, the background elements, the doors, the windows, the stairs, the pillars, the walls, any of the elements on the stage combine to form symbolic references to the stories themselves. The element that he uses most frequently as his focal point of scenery is the spring. In Cat on a Hot Tin Roof, this spring is reduced to a liquor cabinet, which also serves as a kind of shrine of escapism. The shrine also appears in the center of the setting for The Rose Tattoo. In contrast to the sordid atmosphere of the setting, the memory of a crumbling gentility often lingers in the Williams plays, lending a poignancy to the present reality.

The memory is also present in the characterization. Almost every play deals largely with characters who are out of sight--ghosts who haunt the present scene. Of those present on the stage, we see that they usually divide into two opposing armies. Certain members in these forces change sides occasionally, so that the classification is never static. But basically, the pattern is this:

REALISM	ROMANTICISM
Animality	Spirituality
Body	Soul
Masculinity	Femininity
Destructiveness	Fragility
Practical values	Spiritual values
Regimentation	Anarchy
Present	Past
Action	Dreams
Physical death	Physical life
Spiritual life	Spiritual death

The alignment of the main characters according to these ten points forms the clearest pattern in the imagery of Tennessee Williams. For each character in conflict becomes the image of an issue in the greater, cosmic battle waged on the basis of universal issues.

The universal meaning of the images also appears in the words and actions of these characters. For we discover that the patterns of speech reveal the main questions with which Mr. Williams deals:

What are men?
What do they want?
What has the world to offer them?
What is the result?
What is the hope?

The images of this first group include the animals, the children, the insects, the plants, the glass, the streetcars, the trains, and the trucks. The needs and desires of the humans account for their visions of orchards and stars, but the actuality offered by the world is oftener the separation of walls or the steady ticking of the clock so that the head-on collision of dream and reality produces the mutilation, the broken Apollo, the crutch, the brace. But out of this world of desecration rises the phoenix with his perennial message of hope. The rose, the rainbow, and the violet breaking through the rocks become symbols of a hope that lingers amid the ruins.

And through these patterns of imagery, we come to see that Tennessee Williams does use an abundance of images. We see that each of his plays is centered around a single, thematic image, that he in fact sees life with the transforming vision that reduces all of existence to symbolism. The image is the very core of his genius. For by his adept use of this tool, he attains organic unity for his plays, he transmits colors to an otherwise colorless world, he gives an additional dimension of emotion to the words, and thus he achieves a second level of meaning in plays that are already entertaining for their surface stories. In short, Tennessee Williams, in bringing emotional and intellectual enrichment to his dramas, endows them with the lasting value of poetry. Since this author is aware of the pleasure his audience derives from his imagery, since he is aware of its limitations, and since he sees that it contributes most successfully to drama, he will undoubtedly continue to use and to develop his imagery. If he continues to grow as he has in the last fifteen years, the name of Tennessee Williams could easily become as lasting as his images. 370 pages. $4.75. Mic 57-3236

RUDYARD KIPLING'S INDIA

(Publication No. 22,095)

Kanatur Bhaskara Rao, Ph.D.
State University of Iowa, 1957

Chairman: Associate Professor William R. Irwin

This dissertation attempts to evaluate Rudyard Kipling's interpretation of India as reflected in his writings.

Kipling achieved an unprecedented popularity at an early age, as a story teller of Anglo-Indian life. His views on India were conditioned to a large extent by imperialism and a strong belief in Anglo-Saxon superiority. Journalism, which introduced him to literature made demands on his writings, that they be brief, entertaining and "sell well."

He became, therefore, a propagandist emphasising the odd and the abnormal in Indian life, presenting thereby a tortured vision.

Kipling was fascinated by the Anglo-Indians of his time, men of action engaged in the great task of building an empire, and carrying the white man's burden in an alien land amidst trying circumstances, involving great sacrifices. The second chapter examines in detail Kipling's presentation of Anglo-Indian life, which we find to be a great exaggeration of the hardships they faced in India. His description of Anglo-Indian social and official life as it revolved around Simla is acceptable. Kipling becomes an authority on the superficialities of high society in Simla.

The third chapter is devoted to his presentation of Indian native life. Towards the uneducated Indians he had sympathy, but presents them as a group of superstitious, ignorant people, who look upon the white man as "protector of the poor." Towards the educated Indian, however, Kipling had the utmost contempt as manifested in the presentation of the Bengalee character. The educated sought an increasingly equal participation in the administration of their country, which to Kipling - a man who distrusted in democracy - was presumptuous. The educated Indians were also responsible for organising national political movements like the Indian National Congress, which went contrary to Kipling's ideas of the British empire.

Chapter four considers Naulahka, a novel about a small, backward Central Indian native state, in which he collaborated with his brother-in-law, Wolcott Balestier. A tale of melodramatic adventure, it does justice neither to the West nor to the East. By its lack of understanding of the problem of the Indian states and the Indian characters, Naulahka is the worst book by Kipling on India.

The fifth chapter makes a complete and detailed analysis of Kipling's most mature and best work on India, Kim. Published in 1901, it is his last book on India, full of a reminiscent quality, and a sincere attempt to present the Indian synthesis. The Boer War, the loss of his beloved daughter Josephine, all resulted in Kipling's own desire for peace of mind, a quality he reflects in his portrait of the Lama. In presenting the Indian religious spirit and its abiding influence on the people of India, which is the main theme of the novel, Kim gives us a realistic picture of India. It is possibly the best book on India by an Englishman.

The following are the main conclusions derived from this study. 1) That Kipling was primarily a local colourist in his short stories, writing mainly about the Northern part of India. 2) Clouded by the prejudices of a "White Sahib" Kipling lacked a sympathetic participation with the Indian people. 3) In Kim, however, written during his mature period, he reveals a great understanding of India, and since this is his farewell to India, Kipling may be considered as having understood the country he was writing about. 293 pages. $3.80. Mic 57-3237

THE STRUCTURE OF THE SCARLET LETTER AND THE HOUSE OF THE SEVEN GABLES

(Publication No. 22,209)

Edward Coolidge Sampson, Ph.D.
Cornell University, 1957

In analyzing the structure of Hawthorne's works, the critic must take into account the distinction, based on a well-established literary tradition, that Hawthorne makes between the novel and the romance. Hawthorne wrote romances, and he felt entitled to "a certain latitude, both as to fashion and material," that he would not have felt entitled to had he been writing a novel. There is a greater fluidity of structure in the romance, as Hawthorne saw it, than in the novel; and because the writer of romance is not especially concerned with the surface reality of things, there may be a greater freedom in the use of symbolism and imagery.

This study of structure does not pretend to be a complete analysis of the works involved, for no full study could exclude, as this one has done, a consideration of Hawthorne himself, the time in which he lived, and the times of which he wrote. However, the structural elements of a work cannot be confined by the traditional separation of form and content: to exclude meaning in a structural study, as some critics have done, is to make of structure a thing altogether too mechanical. As the word is used here, structure includes the study of symbolism and imagery, plot and character, and theme.

The first chapter of this dissertation records in some detail the historical background of the distinction between the novel and the romance, and describes Hawthorne's use of that distinction. The subsequent chapters deal specifically with The Scarlet Letter and The House of the Seven Gables. No previous studies have fully analyzed the patterns of imagery and symbolism in the two romances. The carefully developed plot of The Scarlet Letter has not been fully set forth, and Hester's dominant role in that plot has been largely unrecognized.

A study of The Scarlet Letter and The House of the Seven Gables reveals the structural superiority of the former. The Scarlet Letter, with its complex but skillfully interwoven patterns of symbolism and imagery, and with its close-knit plot, is a work of the highest artistic unity. The House of the Seven Gables, with its profusion of imagery-patterns, and its sometimes loose symbolism, lacks the disciplined control of The Scarlet Letter. And the plot of The House of the Seven Gables is slow-moving and at times unconvincing. In The Scarlet Letter, there is a clear focus on the characters, with Hester emerging as the chief figure, for it is through her that Dimmesdale receives the strength and the motivation to confess; in The House of the Seven Gables, the emphasis on the characters is divided, and Clifford, intended by Hawthorne as the main character, is not substantial enough for the part.

But if The House of the Seven Gables is weak, it is not the failure that the modern reader is apt to find in The Blithedale Romance and The Marble Faun. The Scarlet Letter, to sum up, stands out clearly as Hawthorne's masterpiece. 371 pages. $4.75. Mic 57-3238

CULTURAL GEOGRAPHY IN THE GERMAN NOVEL OF THE EIGHTEENTH CENTURY

(Publication No. 22,106)

John Andreas Sirevaag, Ph.D.
State University of Iowa, 1957

Chairman: Professor Erich Funke

The intent of this dissertation is to examine the attitudes of some Eighteenth-Century German writers toward foreign countries as those attitudes are revealed in certain representative novels. France, Italy, and England interested them particularly; other nations less so. Generally, the more distant the country, the less the interest displayed. The major exception to this was America, which attracted much attention during the Revolutionary epoch partly because of the hated traffic in German soldiers and partly because of sympathy with the struggle of the Americans for freedom. These two causes were not unrelated. England was hated for her part in the soldier traffic, but admired for her constitution and enterprise. The English were thought reserved and arrogant, greedy and bourgeois, but were respected by the Germans for their naturalness, common sense, cleanliness, sense of duty, and love of country.

Since French influence dominated the social life of the German upper classes as well as German literature, art, and philosophy, native German writers found difficulty in securing recognition. Hence, a strong undercurrent of resentment for the French is apparent in the German novels. Although the French were thought subtle and witty, charming and attractive, and their language was considered beautiful, clear, sensitive, and expressive, they were believed to be superficial but clever frauds, devoting their energies to irresponsible sensuality.

Italy was mysterious but compellingly attractive to the Germans. There Goethe, Heinse and Klinger found, respectively, classical purity and form, a life philosophy, and a moral lesson in depravity. The lovely blue skies and passionate gypsy-like people of Italy left a lasting impression on the German mind.

Other countries aroused little general comment. Holland appeared a nation of polite, good-hearted people whose skill in trade permitted them to exercise great influence in the world. No clear picture of Russia was given. Mysterious and dangerous, barbarous and only half-European, she was peopled by drunken slaves and oppressed by a corrupt government. Spain, much like Italy, was not as fascinating. The Germans hated the Inquisition, Spanish Catholicism, the obscurantist government, the laziness and pride of the people, but were attracted even so by the passion and the brilliant colors of the country. No general picture of the other countries of Europe or of those in the rest of the world can be extracted from the novels.

The novel reflected the cultural and philosophical situation of the time. Klinger, for example, was deeply influenced by Rousseau. The German writers displayed considerable knowledge of the contemporary scene although their judgment became less profound the farther away the country was. They were usually attracted by the cultural rather than the political significance of the country. Since they often used travelogues and travel-diaries as sources of information, their writers preserved the viewpoint of these sources except when they had been abroad themselves; in the latter case, they supplemented the travelogue accounts with personal impressions. Even though the writers reflected the inadequacies and inaccuracies of their sources, their reactions are often sensitively revealing.

On the whole, the novels reflect a definite interest in foreign countries. They indicate a strong attitude of distrust of and dislike for the French and Spaniards but one of respect for the English. Most of the novelists were Protestant; consequently, they had a strong anti-Catholic prejudice, and were frequently rationalistic and moralistic. These facts may explain their criticism of the Latin countries. They had especially strong emotional reactions toward France, England, and Italy. The novelists were aware of the distinct national characters of the various foreign countries. To them the world was colorful and intense but still limited in many ways.

252 pages. $3.25. Mic 57-3239

THE DIALOGUES OF VOLTAIRE

(Publication No. 22,064)

Frederick Augustus Spear, Ph.D.
Columbia University, 1957

The dialogue, a genre which enjoyed a widespread popularity in eighteenth-century France, was not essayed by Voltaire until relatively late in life. It came to be utilized by him at about the same time he began to write philosophical tales, a time when old forms no longer suited new subject matter, and the two genres have many similarities. Indeed, the dialogue is often made an integral part of the conte. Although the Voltairian dialogue reveals certain similarities with the colloquies of Plato, Lucian and Fontenelle, comparison shows that the patriarch of Ferney is essentially original in handling the form.

The protagonists, except those of the serious dialogues, tend to be markedly antithetical; in addition to setting the stage for the development of dramatic situations, this enables the author to handle the opposition between ideas in a clear-cut manner. To attack ideas or abuses viewed by him unfavorably, Voltaire places their defense in the mouths of patently ridiculous characters. The speech of these personages may reveal a rigidity which is laughable; their specialized professional jargon may produce amusement; their automatism may render their every move or observation comical. Socratic and Ingénu forms of irony are used to delineate between characters and to present a desired point of view. The vast majority of these personages are caricatures, and the author did not intend it otherwise, since their function is primarily that of demonstration.

Demonstration is likewise the chief function of the imagery employed. The images may be terse or extended over several speeches, they may be light and witty or reveal righteous wrath; but they are seldom used except in the expression of the author's viewpoint. A substantial number of them, in addition to fulfilling a utilitarian purpose, are aesthetically pleasing as well, revealing the hand of a sensitive artist.

The writer uses a large variety of comic and ironical devices to weigh the balance in favor of a given speaker,

particularly in the comic dialogues. He takes delight in playing with words, using repetition with telling effect. He piles one term upon another or one question upon another for comic effect. Words normally considered mutually exclusive are joined grammatically to produce laughter; sharp and unexpected contrast has a like purpose. The author's wit keeps the reader constantly on the alert and favorably disposed toward acceptance of the message. An ironic point of view is sometimes reflected in the names assigned to the characters. Other satirical devices designed to give the proper nuance to any argument include invective, verbal irony, understatement, satire of equivalence and ingenuousness.

Voltaire shows little concern for formalism. There is no clear distinction made between narrative and dramatic types of dialogues; there is little uniformity as concerns length. Individual short pieces or separate parts of the long ones tend to concern themselves with one main topic, to which all else is subordinated, but notable exceptions exist. They are so constructed and managed that the message is never in doubt, even though it may not always be indicated in express terms. Most of them are expository, having been composed for a propagandistic purpose, and their subjects often represent a crystallization of ideas expressed elsewhere in a more diffuse manner. Dialogues in which there is an earnest search for truth by dialectical means are in a decided minority.

The dialogue is on occasion a lethal weapon in the hands of the philosopher and at the same time a form in which his artistic expression reaches perfection. It is, of course, a minor literary type, but one which is represented by a number of undisputed masterpieces.

154 pages. $2.05. Mic 57-3240

FORMAL VERSE SATIRE FROM LODGE TO JONSON, WITH PARTICULAR REFERENCE TO THE IMITATION OF CLASSICAL MODELS

(Publication No. 22,477)

Ruth Frances Stickney, Ph.D.
University of Minnesota, 1957

Adviser: Huntington Brown

The subject of this study is classical or formal verse satire written in England between 1595 and 1640 on imitation of the Roman satirists, Horace, Persius, and Juvenal. The principal purpose is to show what Thomas Lodge, Joseph Hall, John Donne, and Ben Jonson learned from classical satire and to examine their methods of imitation. An incidental purpose is to show that when other English poets wrote satire largely independent of classical models, they adopted a few conventions from the imitative satirists, took up the current fashion of the "character," and reverted frequently to the methods of medieval and Renaissance satire with its personified abstractions, Seven Deadly Sins, and generalized attacks on groups of men. Included in the discussion of the "independent" vein of English satire are John Marston, Edward Guilpin, Thomas Rowlands, George Wither, John Taylor, Richard Barthwaite, and "R. C.," the unknown author of The Times' Whistle.

The study begins with a discussion of the Roman poets which distinguishes between the style, tone, and manner of Horace, Persius, and Juvenal, and emphasizes those elements of Roman satire which are important in English imitations: the suasive nature of the persona; the satirist's apology for his satire; the dramatic suggestiveness of classical satire; the use of the occasional poem to teach and persuade the reader indirectly; the various literary forms, e.g. dialogue, epistle, dramatic monologue, and dramatic narrative.

Lodge and Hall owe the greatest debt to the Romans for themes and subject matter. In A Fig for Momus (1595), Lodge concentrated on themes and a simplified structure borrowed from Juvenal but rejected the grand style, the tragic tone, and the coarse details for the relaxed, refined manner of Horace. In Virgidemiarum (1597-98), Hall took Juvenal as his master, borrowed themes and content from him freely, and often used the structural arrangement which Lodge preferred--stating the theme early and supporting it with examples or "proofs."

Whereas Lodge and Hall combine adaptation of Roman themes and subject matter and imitation of techniques and formal structure, Donne and Jonson are emulous imitators, naturalizing in England the recurring features of Roman satire: the dramatic qualities, the occasional poem, the convincing persona, and the various literary forms. Jonson, who assimilated the classical method more completely than Donne, gave English satire a precision, discipline, and closely knit structure which it had not had before. Through the satiric contrast, Jonson achieves a rigid rhetorical arrangement and a strict unity which suggest that he knew he had found a way to "overgo" his masters. If he surpassed them in precise integration of parts into a carefully patterned design, he equaled them in managing the occasional poem and in creating a persona who, by appearing in the right character, became his most effective means of persuasion.

The imitative satirists do not rely on the example of one ancient to the exclusion of the other two, and the combined influence of all three Romans appears frequently in individual satires. In direct adaptations, the imitators avoid the crabbedness and obscurity of Persius, the tolerance, detachment, arch pleasantry, and genial humor of Horace, the amplification, grand style, and symphonic sweep of Juvenal. By altering and transforming whatever they borrowed, English poets made the original contributions to the common fund of literature which the classical theory of imitation required. Through creative adaptation of themes, scenes, and characters from Roman satire and through emulous imitation of its structure and techniques, Lodge, Hall, Donne, and Jonson started the English genre on a course which led to Rochester's Allusion, Pope's Imitations of Horace, and Dr. Johnson's London and Vanity of Human Wishes. 326 pages. $4.20. Mic 57-3241

VISION AS IMAGERY, THEME, AND STRUCTURE IN GEORGE ELIOT'S NOVELS

(Publication No. 22,189)

Reva Juanita Stump, Ph.D.
University of Washington, 1957

The hypothesis of this thesis is that in George Eliot's novels the artistically unifying element is the author's concept of moral vision as the deeply felt perception of the human condition, a perception so deeply felt that it must profoundly influence what one is in relation to his fellow human beings. The term is always relative. In all seven novels a rhythm is established and perpetuated by a complex pattern of vision imagery and related patterns, by a group of themes united through the concept of vision, and by the dramatic action which primarily derives its tension from the contradictory urges to see and to avoid seeing. This rhythm, a movement produced by the recurrence of remembered and expected elements connected with vision, is the basic structure of all George Eliot's novels. Throughout this study I have called it the movement toward and the movement from vision.

The rhythm works both in terms of the reader who perceives it as structure and the character with whose vision the novel is concerned. For the character moving toward vision is learning to expect his future, consider his present, and remember his past, all in realistic terms and in relation to a wider referent than self. The character moving from vision has destructive daydreams about his future, fails to consider his present in adequate perspective, and is frequently isolated from his own and the larger past. The life pattern of either character is created through the expected recurrence of progressively clearer or duller visions, depending on the direction of the movement.

This study demonstrates that the major image patterns --concerned with darkness, light, sight, movement, space, restriction, paradise, religious ritual, fertility, sterility, animals, webs, and windows--and the major themes--such as egoism, renunciation, expectations, reform, and marriage--all derive their symbolic meaning either tangentially or directly from the concept of moral vision. My primary concern has been to explore the two antithetical movements toward and from vision, to discover the particular structure which they create in each novel, and to find out how imagery, theme, and dramatic action work together to produce the movements. I have proceeded on the assumption that close analysis of the novels themselves would more readily disclose their artistic meaning than use of pertinent material outside the novels. Indirectly I have dealt with the most prominent critical issues. Because the imagery is a rich source of meaning which often assists in determining how other elements actually function, I have placed much emphasis on it. This is not, however, a study of imagery but rather a study of structural and thematic movement in which imagery is an essential element.

Chapter I established the intention and procedure. Chapters II, III, and IV, the body of the dissertation, are lengthy individual studies of Adam Bede, The Mill on the Floss, and Middlemarch. Chapter V deals with Silas Marner, Romola, Felix Holt, and Daniel Deronda, showing briefly how vision functions as imagery, theme, and structure in these four novels and relating them to the novels studied in detail. This chapter also discusses the significance and development of the role of tutor in the seven novels.

There are many variations on the general structural pattern of movement toward and from vision in these seven novels. But in all seven there is finally more emphasis on the forward movement, for with one exception (Tito's totally destructive movement) the backward movements are ultimately reversed and dissolved into the movement toward vision. The reason for this emphasis, I believe, is that George Eliot is always concerned with asserting and exploring the moral evolution of mankind.

339 pages. $4.35. Mic 57-3242

LA NOVELA ROMANTICA EN HISPANOAMERICA

(Publication No. 22,066)

Marguerite Suárez-Murias, Ph.D.
Columbia University, 1957

The Romantic Novel in Spanish America defines the genre in its history, from 1832 to 1888, in the Spanish-speaking countries of the Western Hemisphere. The work is written in Spanish. It is presented in five parts, which group the countries treated according to spheres of influence or geographical communities. Thus, part one covers the romantic novel in the Antilles, namely, Cuba, Puerto Rico, and Santo Domingo. Part two: Argentine, Uruguay, and Paraguay. Part three: Chile, Bolivia, and Peru. Part four: Colombia, Venezuela, and Ecuador. Part five: Mexico and the present Central American republics — Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, and Panama.

The purpose of the dissertation has been to show the characteristics and development of the romantic novel as it was adapted from Western European sources to Spanish American ideals.

The development of the romantic novel in each country has been studied in relation to the cultural background of the period, with reference to American romantic ideology as expressed by the literary leaders of the time.

In the concluding chapter, the esthetics of these masters is briefly outlined, and the ensuing characteristics of the various types of Spanish American romantic novels are reviewed as a whole. Care is given in pointing out comparatively the native elements. A group of the best representative novels selected from those treated in the main text has been presented. Finally, the contribution of the genre has been evaluated in relation to the period and, ultimately, to the history of the novel in Spanish America.

294 pages. $3.80. Mic 57-3243

THE GRAMMAR OF SUBJECT HEADINGS: A FORMULATION OF RULES FOR SUBJECT HEADING BASED ON A SYNTACTICAL AND MORPHOLOGICAL ANALYSIS OF THE LIBRARY OF CONGRESS LIST

(Publication No. 21,780)

Jay Elwood Daily, D.L.S.
Columbia University, 1957

The subject headings in the Library of Congress list, fifth edition, 1948, were analyzed to determine the function of each grammatical form in the structure of the list. The main headings in the list, at least 21,451, were grouped together according to the form of the heading, the marks of punctuation employed, and the inflections of words in the list. Considerable variation of form was found, but the headings in the list may be summarized as being 31.5 per cent one-word headings; 5.5 per cent proper names of more than one word; 5.5 per cent "events" which are distinguished from other forms in that the heading contains a date and usually the words "Battle", "War", etc.; 6 per cent one-word headings followed by one or more words in parenthesis, 4.5 per cent headings which would be counted as two-word headings except that the Library of Congress list retains a hyphened form. The remaining headings consist of two or more words, about 47 per cent of the main headings in the whole list. The two-word headings are 34 per cent of the total number of headings in the list; 3 per cent of the headings are of three or more words without using a preposition, conjunction, or definite article. The remaining 10 per cent of the main headings use one or more of these function words, about 4 per cent include the word "and", about 5 per cent include the prepositions "in, of, with", and approximately 1 per cent include other prepositions. Only a few headings include the definite article, and only one was found which included the indefinite article.

There are significant variations in the use of certain grammatical forms with suggested Library of Congress classifications, but the analysis revealed a pattern of usage such that a sample of headings based on a subject area would not lead to valid conclusions about the whole list. Three principal uses for marks of punctuation, other than the hyphen, and for the conjunction and prepositions were suggested by the analysis: the grouping of headings together so that the entry word is the same in various modifications, the dispersal of headings so that entry words differ but the same word is used after the mark of punctuation, and the explanation of headings so that the context of the entry word is shown.

A comparison of the grammatical forms used in seven special lists indicated that a single area of usage could be determined for each mark of punctuation, and on this basis rules for use of grammatical form were devised. The problems of grouping and dispersal of headings suggested the need for a classified guide to supplement the alphabetic listing of headings and suggested the use of a mark of punctuation instead of prepositions and conjunctions. A special subject heading list for materials on the desegregation crisis was developed to show the application of the rules. It was not the intention of the study to revise the Library of Congress list of subject headings.

234 pages. $3.05. Mic 57-3244

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

APPROXIMATELY FINITE GEOMETRIES AND THEIR COORDINATE RINGS

(Publication No. 22,664)

James Howard Alexander, Ph.D.
The University of Tennessee, 1957

Major Professor: Wallace Givens

Von Neumann has exhibited a certain class of continuous geometries, called "approximately finite," which can be constructed as limits of finite dimensional projective geometries. In this thesis, it is shown that the coordinate rings of approximately finite geometries can be constructed in an analogous manner as limits of finite dimensional matrix rings.

The lattice-theoretic definition of a polarity as being an involutoric dual automorphism of the lattice of subspaces of a projective geometry applies equally well to continuous geometries. Following Givens, the signature of a polarity is defined to be the dimension of the maximal totally isotropic subspaces. It is shown that there exist approximately finite geometries having polarities whose signatures fill the real interval $[0,\frac{1}{2}]$.

Frink has shown that any approximately finite geometry $\mathcal{L}$ (actually, any complemented modular lattice) is isomorphic to a sublattice of a (possibly reducible) projective lattice ρ. It is proved that ρ has another sublattice that is isomorphic to the lattice of subspaces of an infinite dimensional coordinate geometry over the center of the coordinate ring of $\mathcal{L}$. 71 pages. $2.00. Mic 57-3245

GENERALIZED WINDING NUMBERS AND LIGHT OPEN MAPS

(Publication No. 22,151)

James J. Andrews, Ph.D
University of Georgia, 1957

Supervisor: M. K. Fort, Jr.

The author defines a generalized winding number, minimal maps, and pseudo-monotone maps. He is able to prove the following theorems:

(1) A Light Map f of R^2 into R^2 is Open if and only if f is Minimal.
(2) A Light Map f of R^n into R^m is Open if and only if f is Pseudo-monotone.

30 pages. $2.00. Mic 57-3246

CURVATURES OF RIEMANNIAN MANIFOLDS

(Publication No. 22,246)

Dean Norman Arden, Ph.D.
Purdue University, 1957

Major Professor: Michael Golomb

Geometric interpretations are given for the total curvature of a Riemannian manifold as used by Chern and Allendoerfer in the generalized Gauss-Bonnet theorem and for the invariants used by Weyl in the calculation of the volume of tubes. These interpretations lead naturally to generalizations of the ideas of geodesic and normal curvatures. The exterior derivative of this generalized geodesic curvature is calculated and related to an expression used by Chern in his proof of the generalized Gauss-Bonnet theorem. 64 pages. $2.00. Mic 57-3247

FLOWS OF ISOMETRIES

(Publication No. 22,152)

Rupert Dean Boswell, Jr., Ph.D.
University of Georgia, 1957

Supervisor: M. K. Fort, Jr.

The author classifies flows of affine transformations in the euclidean plane E^2 and flows of isometries in the hyperbolic plane, the elliptic plane, and euclidean n-space E^n. To classify these flows, the author found it necessary to solve several functional equations and certain problems pertaining to flows of matrices; therefore, these solutions are included in this paper.

51 pages. $2.00. Mic 57-3248

AN APPROACH TO THE SAMPLING DISTRIBUTION OF GUTTMAN'S COEFFICIENT OF REPRODUCIBILITY

(Publication No. 21,960)

Ira H. Cisin, Ph.D.
The American University, 1957

The objective of this research is to provide to users of Guttman scales a set of statistical tools which will make it possible, in important special cases, for them to test their results for significance of departure from chance. The results of a scale analysis are customarily presented in the form of a "coefficient of reproducibility"; if the sampling distribution of the coefficient of reproducibility can

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be determined, simple procedures can be developed for testing hypotheses about its observed sample values.

The case considered is specified by the following conditions:

a. The items in the scale are dichotomous;
b. The set of items constitutes a universe of items to the researcher;
c. For each item, a decision is made in advance about which arm of the dichotomy is to be regarded as favorable;
d. The favorable proportion marginals of the items are equally spaced along the continuum from 0 to 100% excluding the limits;
e. The item marginals are fixed, not subject to sampling fluctuation;
f. The point of interest (the conceptual variable whose fluctuation is reflected in the sampling distribution of the coefficient of reproducibility) is the multivariate relationship among the items in the universe of persons under study.

Under the conditions enumerated above, a method is developed for determining the approximate sampling distribution of the coefficient of reproducibility. It is observed that the coefficient is distributed approximately normally, with mean and variance determined empirically from the data under study.

The method is then applied to situations where the number of items under study is 2, 3, 4, or 5; and where the number of persons is approximately 100, 200, ... , 1000. Procedures for extension of the method to larger numbers of persons are provided; the requirements for a machine procedure for extension of the number of items are enumerated.

Application of the findings and procedures of this study are expected to have the following uses:

a. The tables may be used immediately to test the significance of coefficients of reproducibility based on existing data;
b. Where existing data do not conform to the conditions of the test, they may frequently be made to conform by item elimination;
c. Future work may be planned in such a way that results will be tested by the methods offered, without significant loss in generality or applicability of the research;
d. Methods are provided for the development of tests of significance for other special cases of particular interest;
e. Clues and guidelines are offered as to the most promising leads to be pursued toward greater generality and applicability of the kinds of results presented.

111 pages. $2.00. Mic 57-3249

LOCAL OPERATORS ON FOURIER TRANSFORMS

(Publication No. 22,198)

Louis de Branges, Ph.D.
Cornell University, 1957

An operator K(H) is defined partially on the absolutely convergent Fourier transforms by means of a measurable function K(x) of real x. K(H)·f (x) = g(x) means that K(x) F(x) = G(x) where F(x) and G(x) are integrable and f(x) = $\int e^{ixt}F(t)\,dt$, g(x) = $\int e^{ixt}G(t)\,dt$. The operator is said to be local is whenever two functions $f_1(x)$ and $f_2(x)$ in its domain agree in the neighborhood of a point x_0, the images $g_1(x) = K(H)\cdot f_1(x)$ and $g_2(x) = K(H)\cdot f_2(x)$ agree at x_0.

A sufficient condition that K(H) be local is that K(x) agree for almost all real x with an entire function of minimal exponential type. If K(H) has in its domain a function which vanishes in an interval and is not identically zero, the condition is also necessary.

If the modulus of K(x) is an increasing function of x and $\int \frac{\log^+ K(t)\,dt}{t^2+1} = \infty$, then K(H) has in its domain no function which vanishes in an interval and is not identically zero. Compare with Levinson, N. "On a class of non-vanishing functions," Proc London Math Soc (1936) ser 2, pp. 393-407.

26 pages. $2.00. Mic 57-3250

SOME PROPERTIES OF BASIC ORDER RELATIONS IN THE ARITHMETIC OF RELATION ALGEBRAS

(Publication No. 22,133)

M. L. Keedy, Ph.D.
The University of Nebraska, 1957

Adviser: Hugo Ribeiro

A binary relation is a subset of the Cartesian square of some set U (called the primary domain). The operations usually defined for relations are intersection, complementation, conversion, relative multiplication, and relative addition. Any set of subsets of a Cartesian square which is closed with respect to these operations constitutes a "Proper Relation Algebra" (PRA). Abstract relation algebras (RAs) are defined by a set of axioms due to Alfred Tarski.

The principal contribution here is an extension of the arithmetic theory of relation algebras, which grows out of a study of the definitions of order and partial order elements and the conditions under which such elements in an abstract RA are closed with respect to the various operations.

The elements defined first are "entire reflexive partial order," "entire reflexive order," "entire irreflexive partial order," and "entire irreflexive order." These elements are defined in such a way that, in a PRA, they involve every member of the primary domain and are the correspondingly-named kinds of relations.

Given any RA and one of its elements a, an "a-restricted" RA is defined to be the RA consisting of all elements included in $T_a = (a + \breve{a});1;(a + \breve{a})$. The operations in the a-restricted algebra are the same as those in the original algebra except that complementation is relative to T_a. The members of the primary domain involved in T_a, in the case of a PRA, are precisely those involved in a. This definition is used in determining conditions under which a relation will be an order relation of a given type, in case it involves only part of the primary domain.

Non-entire elements, which in the case of a PRA do not involve the whole primary domain, are now defined by giving the same definitions as for the entire elements, but considered in a restricted algebra. The elements defined

in this manner are "reflexive partial order," "reflexive order," "irreflexive partial order," and "irreflexive order." Additional arithmetic conditions are given which characterize dense order and partial order relations.

Some arithmetic lemmas are proved concerning the elements T_a, where a is any element. For example, the following are proved for any a, b: $T_{a.b} \leqslant T_a.T_b$, $T_a = T_{Ta}$, and $(T_a.1');1 = T_a;1$. Additional lemmas are proved which concern the elements T_a, where a is one of the basic order or partial order elements. For example, the following are proved for any reflexive partial order elements a, b: $a.1' = T_a.1'$, $(a.1');1 = a;1$, $a.b.1' = (a.b);1.1'$, and $T_{a.b} = T_a.T_b$. These lemmas are then used to establish necessary and sufficient conditions for closures of the basic elements with respect to the various operations. Certain sets of irreflexive order elements and certain sets of reflexive order elements are shown to constitute lattices.

In the appendix an abstract characterization of a relation which orders a set with a first element is given, as an example of some further extensions of the theory of order elements. It is noted that one form of the axiom of choice can be expressed in the language of the arithmetic of relation algebras. 74 pages. $2.00. Mic 57-3251

IDEALS IN RINGS OF CONTINUOUS FUNCTIONS

(Publication No. 22,268)

Carl William Kohls, Ph.D.
Purdue University, 1957

Major Professor: Leonard Gillman

The basic paper on the subject of rings of real-valued continuous functions, by E. Hewitt, appeared in 1948. Further developments in the same spirit have been published recently by L. Gillman, M. Henriksen and M. Jerison. The major part of this thesis is a continuation of this line of investigation.

The results of Chapter I are for abstract rings, not necessarily rings of continuous functions. They are concerned for the most part with topological spaces which are certain sets of ideals, endowed with the Stone topology. A study of such spaces as objects of interest in themselves was first undertaken by Jacobson; our developments are based on his work. The motivation is the connection of these spaces to certain constructions of the Stone-Čech compactification of a completely regular Hausdorff space. A problem about the embedding of generalized regular rings in a ring with identity is also solved.

In Chapter II we turn to the study of ideals in rings of continuous functions. We are concerned with certain ideals of the ring of bounded continuous functions $C^*(X)$, namely, the ring of functions "vanishing at ∞," the subring of functions with compact supports, and the ideals which are contained in the first ring and contain the second. Here the underlying space is usually assumed to be locally compact Hausdorff. There are two main results: (1) a generalization of the well known theorem that if X is compact then the space of primitive ideals (with the Stone topology) is homeomorphic to X; (2) an algebraic characterization of a certain subclass of the ideals of $C^*(X)$ named above. Some of the other results of this chapter relate rings of continuous functions to algebraic questions raised in Chapter I.

The prime ideals in a ring of continuous functions C(X) (and the subring $C^*(X)$) are considered in Chapter III. It is shown that every homeomorphic image of C(X) or $C^*(X)$ that is an integral domain is a totally ordered ring. We then turn to some special prime ideals – especially N^p, the ideal of all functions vanishing in an X-neighborhood of the point p, which is prime under certain conditions. We prove that the statement that N^p is prime is equivalent to several others, in particular, that $C(X)/N^p$ is a totally ordered ring. It is shown that in some circumstances it is, in addition, a valuation ring. We study $C(X)/N^p$ as an ordered set and as a valuation ring. The prime ideal structure of this ring is also investigated.

156 pages. $2.05. Mic 57-3252

SOME DISTRIBUTIONS RELATED TO COLUMN TOTALS IN SOCIOMETRIC MATRICES

(Publication No. 21,898)

Paul Dixon Minton, Ph.D
North Carolina State College, 1957

Supervisors: Richard Loree Anderson and
George Edward Nicholson, Jr.

Probability distributions are obtained, suitable for use in practice by research workers in sociometry, for one and two column totals in a sociometric "matrix of choice." The two cases of equal and unequal (but fixed) row totals are covered. Exact distributions are obtained and/or approximations indicated for a single column total, for the joint distribution of two column totals, for the sum of two column totals, and for the difference of two column totals, given their sum.

An appendix gives an alternative derivation of the joint distribution of two column totals and indicates the extension to the joint distribution of three column totals.

92 pages. $2.00. Mic 57-3253

COMPARISONS OF THE METHODS OF CLASSIFICATION

(Publication No. 22,284)

Mangalore Vasudeva Pai, Ph.D.
Purdue University, 1957

Major Professor: Carl F. Kossack

The simplest form of classification problem arises when one or more individuals, known to belong to one of two distinct populations π_1 or π_2, have to be classified into π_1 or π_2 in the "best" manner possible, on the basis of certain measurements made on the individuals. Before we can classify an individual into π_1 or π_2, we should decide whether or not the populations are different. Only when π_1 is different from π_2, the classification problem is

meaningful. Thus the problem of discrimination between π_1 and π_2 is closely related to, and normally precedes the classification problem.

The three main methods of classification – those due to Wald, Fisher and Mahalanobis – are essentially problems in testing of hypotheses. Wald's approach to classification is based entirely on the Neyman-Pearson theory of most powerful tests of hypotheses, and implicitly assumes that π_1 and π_2 are different. Fisher's discriminant function analysis deals first with the problem of discrimination between π_1 and π_2 using a "best" linear discriminant function, and secondly, with the problem of classification using this discriminant function as a classification statistic. Mahalanobis's generalized distance" method is used for purposes of discrimination as well as classification.

The discussion is confined to p-variate ($p \geq 1$) normal populations $\pi_1 = N(\mu^{(1)}, \Sigma_1)$ and $\pi_2 = N(\mu^{(2)}, \Sigma_2)$. When first formulated, all the three approaches dealt with classifying a single observation $Z = Col(z_1, \ldots, z_p)$, when $\Sigma_1 = \Sigma_2$ and $\mu^{(1)} \neq \mu^{(2)}$. It is known that in this case, all the three methods are equivalent to one another. The classification problem now is extended, in each of the three methods, to cover the case when m observations, all of which are known to belong to π_1 or π_2, have to be classified, and to the cases: (i)$\mu^{(1)} = \mu^{(2)}$, $\Sigma_1 \neq \Sigma_2$ and (ii) $\mu^{(1)} \neq \mu^{(2)}$, $\Sigma_1 \neq \Sigma_2$, both when the parameters are known and when they are estimated by samples from π_1 and π_2.

In each case, classification statistics and rules have been derived, but no attempt has been made to solve the complex distribution problems involved. Wald's method has been generalized in a straightforward manner, using the Neyman-Pearson theory of testing of hypotheses. In the case of Fisher's method, classification statistics are based on the "best" linear discriminant function used for discriminating between π_1 and π_2. The linear discrimination statistics themselves are obtained in an optimum manner, using the principles underlying the t-test, the F-test and the Fisher-Behren test. When the coefficients in the discriminant function cannot be actually obtained, the classification rules are merely stated.

Using Rao's method of defining the distance between any two populations as an integral along a certain geodesic, explicit expressions for the distance between two univariate normal populations have been derived in all possible cases. Using this distance, methods for discriminating between the two populations, have been described, and compared with the ordinary t-test and the F-test.

The structure of Mahalanobis's D^2-statistic is used to define the "distance" of a cluster of m ($m \geq 1$) observations from π_1 and π_2, and this distance is used for classifying the cluster, as a whole, to π_1 or π_2. In the case of a single observation the distance so defined is sought to be justified partly on theoretical grounds and partly on intuitive notions of "distance." Also, Euclidean distance is used for defining the distance between a population and a cluster of m ($m \geq 1$) observations. The classification rules based on the Euclidean distance are shown to compare favorably with the X^2-test and the normal deviate test, when the parameters are known and π_1, π_2 are univariate Normal.

Finally, all four methods are compared and contrasted in the different cases, both when the parameters are known and when they are estimated. It is shown that even in the case of m observations, the three approaches of Wald, Fisher and Mahalanobis lead to the same result, when $\Sigma_1 = \Sigma_2$. In certain cases, the Euclidean distance method of classification is shown to give results similar to the other three methods. 105 pages. $2.00. Mic 57-3254

ON THE UNIQUE CONTINUATION THEOREM FOR CERTAIN ELLIPTIC PARTIAL DIFFERENTIAL EQUATIONS

(Publication No. 22,472)

Roger Noel Pederson, Ph.D.
University of Minnesota, 1957

Adviser: A. N. Milgram

In this thesis we prove the following unique continuation theorems.

Theorem 1. Consider the partial differential equation

$$\text{(i)} \quad \sum_{i,j=1}^{n} a_{ij}(x) u_x i_x j + \sum_{i=1}^{n} b_i(x) u_x i + c(x)\mu = 0$$

defined in a domain D in Euclidean n-space, $x = (x^1, \ldots, x^n) \in D$. We assume that $a_{ij} \in C^2$, $\sum_{i,j=1}^{n} a_{ij}\, \xi\, i\, \xi j > 0$, for $x \in D$, $\xi\, i \neq 0$, and that b_i and c are bounded. If u is a solution of (i) which vanishes in a subdomain of D, then $u \equiv 0$ in D.

Theorem 2. Consider the partial differential equation

$$\text{(ii)} \quad \Delta^2 u + \sum_{i,j,k=1}^{n} a_{ijk} u_x i_x j_x k + \sum_{i,j=1}^{n} b_{ij} u_x i_x j + \sum_{i=1}^{n} c_i u_x i + du = 0$$

defined in a domain D in Euclidean n- space, $x \in D$. We assume the functions a_{ijk}, b_{ij}, c_i, and d to be variable but bounded. If u is a solution of (ii) which vanishes in a subdomain of D, then $u \equiv 0$ in D.

In order to prove theorem 2 we establish the following inequality.

Let $r = [\Sigma(x^i)^2]^{\frac{1}{2}}$ and let Bu represent the sum of the squares of all derivatives of order less than or equal to 3. If u(x) is a twice continuously differentiable function such that $u = 0$ near $r = 0$ and for $r \geqslant R$, then

$$\int_{r \leqq R} \exp(\alpha/r)\, (\Delta^2 u)^2\, dV \geqslant (1/32R^2) \int_{r \leqq R} \exp(\alpha/r)\, Bu\, dV$$

for all α sufficiently large.

Theorem 1 is proved by using a similar inequality.

We also obtain conditions under which the above theorems are true when the lower order coefficients have singularities of finite order at the origin.

42 pages. $2.00. Mic 57-3255

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

ON THE THEORY OF ASYMPTOTIC DISTRIBUTIONS (MOD 1) AND ITS EXTENSION TO ABSTRACT SPACES

(Publication No. 22,299)

James Hall Stapleton, Ph.D.
Purdue University, 1957

Major Professor: J. H. B. Kemperman

The purpose of this thesis is to extend the theory of asymptotic distributions (mod 1) of real sequences to a more orderly and systematic theory on sequences of points in a locally compact space H or an abelian locally compact group G, both second countable.

We first mention a few results of Chapters I and II. Let L denote the vector space of continuous complex-valued functions on H having compact support. Then the positive linear functional μ on L can be identified with the Borel measures $\mu(E)$ on H by means of the formula

$$\mu \cdot f = \int_H f d\mu, \text{ for each } f \in L.$$

A sequence of such functionals $\{\mu_n\}$ is said to converge weakly to a functional μ if $\mu_n \cdot f \longrightarrow \mu \cdot f$ for each $f \in L$. It is shown that convergence of a sequence $\{\mu_n\}$ to μ is equivalent to the convergence of $\mu_n(E)$ to $\mu(E)$ for each bounded Borel set E having a boundary of μ-measure zero. Another important result is that for each sequence $\{\mu_n\}$ of (Borel) measures such that $\mu_n(C)$ is bounded for each compact set C there exists a weakly convergent subsequence; this generalizes a well known-result for Borel measures on the real line.

Let $\{x_k\}$ be a sequence of points in H. Then

$$\mu_n \cdot f = \frac{1}{n} \sum_{k=1}^{n} f(x_k), \text{ for each } f \in L$$

defines a Borel measure on H, n = 1, 2,... If μ_n converges weakly to a Borel measure μ, μ is called the asymptotic measure of the sequence $\{x_k\}$. Generalizing a theorem due to van der Corput concerning measures on the real line, it is shown that (essentially) each dense sequence of points in H can be reordered so as to have an arbitrary preassigned asymptotic measure μ with $\mu(H) \leq 1$.

The last four chapters are devoted to the group G. It is proved that μ_n converges weakly to μ if its Fourier transform $\mu_n \cdot (x, \hat{x})$ converges to $\mu \cdot (x, \hat{x})$ for almost all elements x in the dual or character group $\hat{G}$ of G. This theorem is the major tool of the last three chapters. Applying it to the measures μ_n associated with a given sequence $\{x_k\}$ of points in G one obtains a wide generalization of the so-called Weyl criterion. Further, necessary and sufficient conditions for convergence and independence of random variables taking values in G are given in terms of the Fourier transform of their distribution. It is proved that convergence in probability of such random variables implies convergence in distribution.

In Chapter VI many new results are obtained for the case that G is compact. Then G has a finite Haar measure υ with $\upsilon(G) = 1$, the so-called uniform distribution. For each $x_o \in G$, $\{nx_o\}$ has as its asymptotic measure the uniform distribution on the compact group Γ_1 generated by x_0. Here $\Gamma_1 = G$ if and only if $(x_o, \hat{x}) = 1$ implies $\hat{x} = \hat{e}$. Another typical result is as follows: if T is a homomorphism of G into a topological group Y and ξ is a random variable in G having a uniform distribution then $T(\xi)$ has a uniform distribution on T(G). The last chapter (VII), contains some miscellaneous results on random variables taking values in the additive group I of the real numbers (mod 1). 141 pages. $2.00. Mic 57-3256

THE THIRD OBSTRUCTION IN COMPLEX PROJECTIVE SPACES

(Publication No. 22,214)

Norman Stein, Ph.D.
Cornell University, 1957

Given a map f of the 2-skeleton of a space X into complex projective n-space C_n we study the problem of extending f over the 2n+3-skeleton of X. Necessary conditions, involving universally defined cohomology operations are known from the work of other authors. Assuming that these are satisfied, we define second-order cohomology operations Ψ_n and give necessary and sufficient conditions in terms of these. In the course of this work we study certain Whitehead products in the homotopy groups of C_n and this gives a complete computation of these products. Finally, with a restriction on the fundamental group of the space involved, we give a formula relating Ψ_n to first order cohomology operations, which allows the computation of Ψ_n in special cases.

41 pages. $2.00. Mic 57-3257

AN ORTHOTROPIC CIRCULAR DISK SUBJECTED TO ITS OWN WEIGHT WHEN SUPPORTED AT A POINT

(Publication No. 22,234)

James Blake Wilson, Ph.D.
The University of Florida, 1957

A substance which has three mutually perpendicular planes of elastic symmetry is said to be orthotropic. A disk cut from such a material parallel to a plane of symmetry will have two perpendicular axes of symmetry in its own plane and is called an orthotropic disk. In this discussion the stress distribution is determined for a circular orthotropic disk subjected to its own weight when supported, with its plane vertical, (1) at a point on its boundary and (2) at a point at its center. Point support is considered to imply uniform support along a line segment joining the faces of the disk and perpendicular to each face at the point specified. The problem is the mathematical idealization of the problem of a wooden disk suspended in a vertical plane from a point on its boundary or, in the second case, from a slender peg at its center.

The dissertation is divided into three chapters. The problem is treated as one of plane stress, and the stresses are obtained in each case from a stress function. In Chapter I the fourth order partial differential equation governing stress distribution, actually, governing the stress function, in an orthotropic disk is derived and a

general solution is obtained, in which the variables, denoted by z_1 and z_2, are complex. Also, equations expressing the effect of boundary forces are given.

The stress distribution in the disk supported at a boundary point is obtained in Chapter II. This case is treated as the limit of the case in which the supporting force is distributed uniformly over an arbitrarily small area on the boundary. Mapping functions ζ_1 and ζ_2 are obtained which map the images of the disk in the z_1- and z_2-planes into annular regions in the ζ_1- and ζ_2-planes, of which the outer boundaries are unit circles. The stress function is assumed in the form of the sum of two Laurent series in ζ_1 and ζ_2, and the constants are evaluated from the boundary conditions and from considerations of continuity and single-valuedness.

The stress distribution in the disk supported at its center, considered in Chapter III, is obtained by (1) finding the stress distribution due only to the supporting force, with no gravity force, and (2) superimposing the stress distribution due to the weight of the disk, with the requirement that the resultant stresses be zero on the boundary of the disk. A stress function is assumed for each of these cases, the function in the second case having the same form as the one in the problem of Chapter II. The constants in these functions are evaluated, in general, as in Chapter II, use being made also of the symmetry of the stresses.

In each of Chapters II and III the displacements in the disk are obtained following the determination of the stresses, and in Chapter II the stress function for the orthotropic disk is shown to contain as a limiting case the stress function for an isotropic disk under the same conditions. 104 pages. $2.00. Mic 57-3258

ON WARING'S PROBLEM WITH CUBIC FUNCTIONS

(Publication No. 22,235)

Richard Lee Yates, Ph.D.
The University of Florida; 1957

This dissertation is concerned with three aspects of the representation of positive integers as a sum of a finite number of values of a cubic function: the representation of all positive integers, the representation of all sufficiently large positive integers, and the representation of certain classes of sufficiently large positive integers. Certain necessary conditions are found for the coefficients E, D, and C of the cubic function $F(x) = \frac{E}{6}(x^3-x)+Dx+C$ in order that all positive integers may be represented as a sum of nine values of the function. From these conditions we arrive at formulae for determining all such possible functions. In particular the case with $E = 1$ is discussed. Two new functions with $E = 1$ are determined by means of the formulae and it is shown that all positive integers are a sum of nine values for each function.

Then a generalized representation theorem is proved which, together with certain suitable regular ternary quadratic forms, can be used to prove specific theorems concerning the representation of all sufficiently large integers or certain classes of sufficiently large integers as a sum of eight values of the cubic function $f(x) = \frac{E}{6}(x^3-x)+Dx$. By using the two regular ternary quadratic forms $x^2+y^2+2w^2$ and $x^2+2y^2+10w^2$, two specific theorems are then proved and shown to cover different sets of integers.

It is then shown that certain of the 102 regular ternary quadratic forms cannot be used to prove specific representation theorems by means of the generalized representation theorem. The elimination of these unsuitable forms together with those eliminated by the conditions of the generalized representation theorem itself leaves fifteen regular ternary quadratic forms for use in proving specific theorems. 52 pages. $2.00. Mic 57-3259

MINERALOGY

PETROLOGY AND STRUCTURE OF ANTELOPE ISLAND, DAVIS COUNTY, UTAH

(Publication No. 22,149)

Willard N. Larsen, Ph.D.
University of Utah, 1957

Chairman: Professor B. F. Stringham

Antelope Island, Davis County, Utah, is the first range west of the central Wasatch Range and is nearly surrounded by waters of Great Salt Lake.

The island consists mainly of two Precambrian sequences of different ages. The older sequence, termed the Farmington Canyon complex, is generally considered Middle (?) Precambrian in age. It is a crystalline complex and its mineralogy indicates a moderate degree of regional metamorphism corresponding to the lower amphibolite facies. Three unnamed units are defined and measured. The lower-most unit consists of 4,207 feet of quartzo-feldspathic schist containing thin amphibolite beds. The intermediate unit totals 2,520 feet of microcline schist containing interbedded quartzo-feldspathic schists, mica schists, and amphibolites. The uppermost unit is predominantly quartzo-feldspathic schist containing interbedded amphibolites, quartz schists, and metaquartzites which totals 13,032 feet in thickness.

The younger sequence is less metamorphosed and exhibits a mineral assemblage corresponding to the greenschist facies. This sequence lies in overlapping fashion

as well as with angular unconformity on the older sequence, and consists of 1,000 feet of strata composed of tillite, dolomite, slate, and quartzites. Generally these strata are considered Upper Precambrian in age and are correlated with the Mineral Fork tillite and Mutual (?) formations of the Wasatch Range.

Other strata on the island are Tertiary conglomerate and fresh-water limestones which are correlated with the Wasatch group of the Wasatch Range. Huge boulders of Madison limestone of Mississippian age weather out of the Tertiary limestones.

Evidence is found which indicates three major unconformities: (1) Basal Upper Precambrian, (2) Basal Mississippian, and (3) Basal Tertiary. The Basal Mississippian unconformity is inferred. It is thought that Mississippian strata were deposited directly on quartzites of Upper Precambrian age in the Antelope Island area.

Structurally the island is an arcuate, northwest-southwest trending, asymmetrical anticline with steeply dipping limbs. The anticline is defined only by strata of the Farmington Canyon complex and its folding brought about a partial retrogression from the original metamorphic grade to the upper epidote-amphibolite facies. Folding probably occurred in Middle Precambrian time. Upper Precambrian strata were cataclastically metamorphosed when essentially superficial forces developed granulation, shearing features, slaty cleavage, and near-isoclinal folds with northeast trending axes arranged perpendicular to the forces. This metamorphism is considered a result of northwest forces imposed during the Cedar Hills or Laramide orogenies. General collapse of the northern part occurred along high-angle normal faults following the metamorphism.

185 pages. $2.45. Mic 57-3260

MUSIC

THE NATIONAL ASPECTS OF THE MUSIC OF RALPH VAUGHAN WILLIAMS

(Publication No. 22,194)

John Dagfinn Bergsagel, Ph.D.
Cornell University, 1957

The Englishness of Vaughan Williams' music is one of the most widely accepted facts of twentieth-century music. He has for many years been recognized at home and abroad as the leader and most typical representative of contemporary English music. The present study is the first attempt to provide a comprehensive answer to the question of how and why this should be so. It becomes significant, then, not only to discover in what respect his music is English, but, viewing English music historically, to discover why Vaughan Williams' Englishness is important. Accordingly, the present study is initiated with a survey of the historical background to the English nineteenth-century renaissance.

The idea of a national music meets with considerable criticism today in various circles, social, political and cultural, revealing a widespread misunderstanding of the problem as it exists today. Therefore the next stage of this investigation is concerned with a consideration of the problem of national music, and of Vaughan Williams' concept of national music. The central thesis of this concept is simply that music must express the composer as a product of his environment. To do this it is impossible to ignore the cultural heritage of one's surroundings which are so largely determined by nationality. In a public address Vaughan Williams once singled out for special commendation "Cecil Sharp, who restored to us our own natural melody, and Edmund Fellowes, who rediscovered the great choral works of the past. . . ." In this tribute there can be little doubt that he is speaking of the two musical influences he feels to have been most important to himself. Following this lead, chapters are devoted to investigations of the nature of the influence of English folk song, and of English Tudor music on Vaughan Williams' musical style.

By way of summary the influence of folk song may be seen in various ways in Vaughan Williams – first, of course, in comparatively few instances, in the actual presence of folk melodies in his music; then on the next level, in the shapes of phrases and in the use of characteristic patterns, figures, and embellishments; in more obvious, metrical copies, and in more remote rhapsodical derivatives, though the responsibility for the rhapsodical nature of many of Vaughan Williams' melodies must, like modality, be shared to some extent by plainsong. A great deal of folk song influence can be traced to a remarkable family of melodies which were among the first folk songs to impress Vaughan Williams.

A survey of so-called "Tudor" influences reveals influences as wide-ranging as the organum and fauxbourdon of pre-Tudor music and the religious thought and the hymnody of the seventeenth and eighteenth centuries. Nevertheless the description "Tudor" is probably justifiable since it is quite apparent that most of the factors which are taken under consideration throughout this chapter, if not actually having their origin in the Tudor period, have at least been present in Tudor music. And certainly it was the revival of Tudor music in the second and third decades of this century that made it possible for English audiences to recognize their heritage.

The final chapter of this study turns from a consideration of the manner in which Vaughan Williams has responded specifically to his musical heritage to consider various other factors, psychological and physical, whose influence has ensured the continuity of the English "national character."

Finally, the bibliography which comprises the last section of this project, while naturally laying no claim to completeness, is nevertheless thought to be by far the largest bibliography of the whole field of English music yet accumulated. It has been the author's intention to make a comprehensive list of books and articles about

English music, including many that have not been specifically quoted in the text itself, and as such it is offered as an integral part of this contribution to an understanding of English music. 329 pages. $4.25. Mic 57-3261

DANIEL-FRANÇOIS-ESPRIT AUBER: (1782-1871). A CHAPTER IN FRENCH OPÉRA COMIQUE.

(Publication No. 22,202)

Rey Morgan Longyear, Ph.D.
Cornell University, 1957

By virtue of his long life and his prolific output of generally high quality, Daniel-François-Esprit Auber (1782-1871) was selected as the central figure in a study of French opéra comique of the first half of the nineteenth century.

In Auber's youth, the eighteenth-century opéra comique, which had been brought to its peak by Grétry, had split into the serious "rescue opera" of Lesueur and Cherubini and the old tradition of amusing comedy or sentimentality, continued by Dalayrac and Gaveaux. Between 1800 and 1820 Boïeldieu and Isouard revitalized this latter genre, but after 1820 it fell strongly under Rossini's influence. Auber's principal contribution was the establishing of a synthesis of French and Italian styles into a classic peak of opéra comique, in which he was aided by Herold and Halévy.

Between 1848 and 1860 new divisions of opéra comique arose, all begun by disciples of Auber. One, started by Adam, became the operetta of Offenback and Hervé; another, started by Grisar and Massé, became the lyric operetta of Audran and Planquette, while the most important, lyric opera, was begun by Thomas. Auber continued to write opéras comiques until 1869, after his style had become epigonous.

Paralleling the musical development of opéra comique was the history of its libretto. Music was generally ancillary to the pre-1825 specimens, which were generally sentimental or bourgeois comédies. The change took place through Augustin-Eugène Scribe (1791-1861), whose librettos from 1823 to 1861 were set by almost all the composers of opéra comique, especially Auber. His librettos, like his "well-made plays," are aggregates of complex incidents and involved intrigues which are not resolved until the final scene. The most common of these is the mistaken identity of a central character.

Auber's first period of composition, from 1813 to 1825, is experimental, characterized by imitations of the styles of Cherubini, Boïeldieu, and Rossini. In his second and best-known period, he abandoned the dramatic-contrapuntal style of Cherubini for a synthesis of the tunefulness of Boïeldieu, the sparkling orchestration and brio of Rossini, and the rhythms of the ballroom dances of his time. His third period, from 1843 to 1869, is characterized by a depth of personal feeling marked by expressively soulful melodies and harmonic richness, but after 1847 his style showed signs of exhaustion.

Auber is at his best in his ariettes, his overtures, and his ensembles which show dance-like influences. His chief defects are a static harmonic rhythm and tendencies to the repetition of short-winded melodic motives. Piquant dotted rhythmic figures and chromatic seasonings of the melody or the harmony are hallmarks of his style.

The best examples of Auberian opéra comique are deserving of revival, especially by amateur and television opera groups. 439 pages. $5.60. Mic 57-3262

SYMPHONY NUMBER ONE

(Publication No. 22,093)

Leroy Ostransky, Ph.D.
State University of Iowa, 1957

Chairman: Professor Philip Bezanson

FIRST MOVEMENT

The first movement opens with a short introduction in the strings. At the Allegro non troppo, the movement proper begins, cast in a modified sonata-allegro form.

The exposition consists of a principal theme – basically a rhythmic idea – and a second theme, flowing and lyric in character. The second theme appears, at first, incipiently; it is not until eight measures after letter C that it appears in its true form.

After a short working of the second theme, the development starts, at letter E. The first half of the development is derived from the first theme and the second half from the second theme. At letter J the recapitulation begins. Here, instead of the opening Lento, the Allegro tempo is maintained and the introductory material is shown in augmentation.

The development is then followed by a telescoped version of the exposition. At letter N, a fughetta – based on the head of the principal theme – acts as coda for the entire movement.

SECOND MOVEMENT

The second movement is cast in a large ternary form. The theme of the "A" section is given over to the solo flute. The "B" section follows, not so much a thematic contrast to the "A" section as a textural contrast.

The opening and closing "A" sections are light and thin, with orchestral emphasis on the solo instruments; the middle section is full and heavy, with emphasis on the orchestral tutti. A statement of the "A" theme in the strings closes the movement.

THIRD MOVEMENT

The third movement is cast in a sonata-rondo form. The rondo-theme ("A") is stated immediately in the brasses and is, itself, a small ternary form. At letter C, the "B" section appears, after which it returns to the rondo-theme at seven measures after letter E.

At letter G, the development (or "C" section) starts. The material here is derived from the rondo-theme. At letter N, a chorale, derived from the introduction of the first movement, leads back to a short version of the rondo-theme at letter O. This is followed by allusions to thematic material taken from the principal theme of the second movement.

The coda, from letter P to the end, is a recapitulation

of thematic fragments from the first movement. The coda is intended to recapitulate and revive the spirit of the first movement. 114 pages. $2.00. Mic 57-3263

THE TWENTIETH CENTURY PIANO SONATA

(Publication No. 21,946)

Henry Samuel Wolf, Ph.D.
Boston University Graduate School, 1957

Major Professor: Professor Karl Geiringer

Since in the twentieth century the piano is no longer the important instrument that it had been in the nineteenth century, composers write less for it in any form, especially the sonata-form. The most prolific composers have been the Americans and Russians with Scriabin, Prokofieff, Medtner, and Miaskowski extremely active. Many of the most important artists of the century have completely ignored the form, Sibelius, Schoenberg, Debussy writing no piano sonatas whatsoever, and Strauss and Berg writing only in their youth. Bartok, Stravinsky and Ravel have written only one work in this form.

Sonatas from the following countries were examined: Germany, Austria, Poland, Roumania, Czechoslovakia, Hungary, Russia, France, Italy, Spain, Latin America, Great Britian, and the United States. In considering each country, a brief historical background of those composers writing piano sonatas was included. The sonatas were analyzed according to: (1) musical form, (2) melodic content, (3) rhythmic elements, (4) harmonic characteristics, (5) contrapuntal devices, (6) pianistic styles and devices, and (7) general characteristics and trends. Contrasts, similarities, influences were noted and an effort was made to ascertain the directions the sonata style was following in each of the countries.

It was found that most of the composers have followed the traditional sonata-form. The fugue appears often enough to be a significant device in the modern sonata. The most noteworthy examples are the fugues by Barber, Hindemith, Carter, and Dutilleux. There are fine sets of variations in the Sonatas of Fuleihan and Dutilleux (Chorale and Variations). There are distinguished one-movement Sonatas by Bax, Berg, Krein, Prokofieff in his First and Third. Instances of this form among American composers are works of Barth, Harrison, Josten, Turner, and Steinert.

Greatest experimenting with rhythms is noticeable in works of the following composers: Scriabin, Stravinsky, Krein, Harris, Bartik, Antheil, Becker, Chavez, and Blacher, all of whom employ frequent metrical changes within a comparatively brief section. Ives and Sorabji dispense with bar lines or metrical indications.

Harmonically, there are a number of sonatas written in a conservative manner, even some of the more recent works. Instances of this conservatism are found in works of Campbell-Tipton, Maganini, MacFadyen, MacDowell, Converse, Powell, Shepherd, Steinert, Stockhoff, Collingwood, Jarvis-Read, Dukas, D'Indy, Genzmer, Degen, Raphael, Rathaus, Axman, Schulhoff, Gretchaninoff, Alexandrov, Glazounoff, Medtner, E. Halffter, Turina, Bastianelli, Castelnuovo-Tedesco, Bucchi, Mainardi, and J. M. Castro. Highly individual harmonic idioms are those of Copland, Griffes, Ives, Milhaud, Ravel, Hindemith, Einem, Krenek, Husa, Prokofieff, Kabalevsky, Scriabin, Shostakovitch, and Stravinsky. Free contrapuntal writing is responsible for some sharply dissonant passages as in Sonatas of Bartok, Griffes, Stravinsky, Scriabin, and Milhaud. Atonality is the basis for the Sonatas of Ardevol, Chavez, Dallapiccola, Liebermann, and Spinner with Spinner being the only one to adopt the twelve-tone technique. Such composers as Rachmaninoff, Lopatnikoff, Miaskowski, Golubev, Frolov employ a form of contrapuntal writing which is more pianistic than intellectual.

While there is considerable ingenuity and originality of style, the traditional idioms of Chopin, Schumann, Brahms appear in many of the works, even up to the present. In 1943, Lopatnikoff imitates the style of Chopin while at the same time Prokofieff in his Eighth Sonata writes in the manner of Schumann. Brahms' influence is felt in Shepherd, Medtner, Rathaus, and Goldschmidt. The techniques of impressionism do not lend themselves to the formality of the classic sonata-form although Ravel, Ruyneman, and Auric have composed sonatas in the idiom. An instance of a slow movement influenced by impressionistic devices is that of the Elliot Griffis Sonata. Highly original styles occur in the writing of Ives, Becker, Liebermann, Bartok, and Antheil in his "Airplane" Sonata.

Among individual composers, Dutilleux, Medtner, Miaskowski, Rachmaninoff, Bax, Fuleihan, Stravinsky have written distinguished works. The sonatas that seem most successful are those of Griffes, Bartok, Barber, Dukas, Hindemith, the mature works of Scriabin, Kabalevsky, and the later works of Prokofieff with particular emphasis upon his Seventh Sonata.

593 pages. $7.55. Mic 57-3264

THE PHARMACO-HEMATOLOGY OF CERTAIN CARBAMATES

(Publication No. 22,442)

Eleanor Berman, Ph.D.
University of Minnesota, 1957

Adviser: Harold N. Wright

The general pharmacological, toxicological and hematological effects of the administration of eight carbamates were observed in normal rabbits, normal weanling C_{58} hybrid mice and leukemic C_{58} hybrid mice. The compounds studied were isopropyl-N-phenyl carbamate, n-butyl carbamate, ethyl-N, N-diphenyl carbamate, ethyl-N-phenyl carbamate, n-propyl carbamate, ethyl-N-phenyl-N-benzyl carbamate, ethyl-N-methyl carbamate, and ethyl carbamate (urethane).

Complete blood studies, including the determination of hemoglobin concentration, enumeration of erythrocytes, reticulocytes, platelets, leukocytes, reading of blood smears, were done on all rabbits and mice used prior to the initiation of drug therapy. Coagulation and prothrombin times were performed on rabbits only.

Hemoglobin concentrations determined in forty rabbits ranged from 11.2 to 15.8 grams per cent. Erythrocyte counts produced color indices of 0.7 to 0.98. Cells were microcytic and hypochromic. Most rabbits had platelet counts between 200,000 and 500,000. Reticulocytes ranged between 0.3 and 3.0 per cent. Leukocyte counts varied from 4,000 to 15,000 with an average neutrophile:basophile: eosinophile:monocyte:lymphocyte ratio of 22:4:1:1:72.

Hemoglobin levels in two-hundred and fifty C_{58} hybrid weanling mice varied from 10.8 to more than 18 grams per cent. Erythrocyte counts completed on thirty mice ranged between 7.9 and 12.5 million cells, giving color indices between 0.5 and 0.6. Mouse erythrocytes were microcytic but well filled with hemoglobin. Platelet counts in mice were of the same order of magnitude as those in rabbits. Reticulocyte counts varied from 0.2 to 7.0 per cent. Leukocyte counts ranged from 4,000 to 12,000 with ten to twenty per cent neutrophiles.

Isopropyl-N-phenyl carbamate in oral doses of 0.1 gm./kg. to 0.75 gm./kg. had little effect upon the hematological picture of rabbits. Administration of a one per cent drug diet to normal C_{58} hybrids did produce a hemoglobin deficit and weight loss. Feeding this drug to leukemic mice shortened their survival time by thirteen per cent.

The administration of n-butyl carbamate, subcutaneously, in doses of 0.15 gm./kg. to 0.5 gm./kg. depressed the hemoglobin concentration and lymphocytes in rabbits and induced central nervous system disturbances. A similar irritability was induced in normal and leukemic mice by feeding a 0.25 per cent drug diet. The survival time of leukemic mice was increased by 8.5 per cent.

Ethyl-N, N-diphenyl carbamate in oral doses of 0.3 gm./kg. to 0.75 gm./kg. lowered hemoglobin levels in rabbits and increased the appearance of nucleated erythrocytes. A two per cent drug diet fed to mice decreased their hemoglobin concentration. Leukemic mice survived 9.9 per cent longer.

The oral administration of 0.25 gm./kg. of ethyl-n-phenyl carbamate caused lymphocyte depression in rabbits. Normal mice fed a one per cent drug diet showed no appreciable effect. Following its administration, leukemic C_{58} hybrids survived 52.6 per cent longer than did untreated leukemic mice.

Normal-propyl carbamate, administered in 0.25 gm./kg. to 0.5 gm./kg. doses subcutaneously, caused a slight lymphocyte depression in rabbits. A three per cent drug diet depressed lymphocytes, hemoglobin levels. Leukemic C_{58} hybrids survived 39.2 per cent longer after its administration.

Ethyl-N-phenyl-N-benzyl carbamate in 0.3 gm./kg. to 3.0 gm./kg. doses markedly lowered hemoglobin concentrations and increased the number of reticulocytes in both rabbits and mice. The survival period of leukemic C_{58} hybrids was decreased by 32.1 per cent.

The subcutaneous injection of ethyl-N-methyl carbamate in doses of 0.5 gm./kg. to 1.0 gm./kg. in rabbits caused a slightly lower hemoglobin level plus a lymphocyte depression. An 0.8 gm./kg. dose, intraperitoneally, in mice depressed the number of leukocytes. Its administration to leukemic C_{58} hybrids increased their survival by 25.9 per cent.

Ethyl carbamate (urethane) in oral doses of 25 mg./kg., 50 mg./kg., 100 mg./kg., 200 mg./kg. had a tendency toward a leukocyte depression. Subcutaneous doses of 100 mg./kg., 400 mg./kg. depressed leukocytes. A subcutaneous dose of 1.2 gm./kg. in a rabbit decreased the hemoglobin concentration and number of lymphocytes. All subcutaneous injections of urethane induced the formation of necrotic lesions at the injection site.

A 0.75 gm./kg. dose of ethyl carbamate, administered intraperitoneally in mice, depressed the hemoglobin level, leukocyte count, and lymphocytic elements. Urethane, though it did prolong the survival of leukemic mice by 13.2 per cent, left the survivors in poor condition.

Ethyl-N-phenyl carbamate of all the compounds tested prolonged the survival of leukemic mice the longest (52.6 per cent). Its side effects were minimal.

164 pages. $2.15. Mic 57-3265

AN INVESTIGATION OF TISSUE CULTURE TECHNIQUES FOR PHARMACOLOGICAL STUDY

(Publication No. 22,224)

Carl Matthews Dumbauld, Ph.D.
The University of Florida, 1957

A few of the general principles governing tissue culture were outlined. The methods of tissue culture currently

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

being used in Pharmacology were reviewed and discussed. They were classified as: those depending upon measuring the area of new cell growth; those noting the changes occurring in individual cells; and those measuring the total number of cells per unit of volume.

In the experimental work an alternative method utilizing the double coverslip principle, but eliminating the costly large well depression slide, was outlined. This method retained the small coverslip holding the explant, but substituted a large slide for the large coverglass, and a watch glass for the large well of the depression slide. The practicability of this method was demonstrated by the successful cultivation of a number of different tissues from chick embryos.

An example of the application of the hanging drop method to a pharmacological problem was performed by testing a new compound (Tetramine) for cytoplasmic toxicity. Three small series of tests were made with this compound, and a conclusion reached that although there were some indications of toxicity, there were also evidences against toxicity. It was not definitely and constantly toxic in the same concentration.

A simplified method for making quantitative determination by measuring the percentage increase in number of cells was proposed. In this method, the culture vessel was a small-necked serum vial fitted with a sleeve type rubber stopper. The cells and medium were introduced into the vial by means of a Tuberculin syring fitted with a small gauge needle. The same method was used for withdrawing the cell suspension for enumeration.

Strain MB III cells were chosen for use because they had been successfully propagated in an even suspension by growth in a medium which was kept continuously and vigorously agitated. A wheel making 2,000 revolutions per hour was constructed for carrying the vials, which were held with the neck elevated five degrees from the horizontal. After three days' growth, a suspending solution of Methocel was injected for dilution purposes. After further sufficient rotation to insure an even mixture, comparative counts were made on each test vial and its companion control vial. This procedure was not fully tested because of inability to build up an adequate stock of healthy cells.

When the agitated medium method of tissue culture was not able to be used for testing, additional tests for the toxicity of Tetramine by other methods were performed. By the Modified Double Coverslip Method, vigorous fibrocytes from young rat hearts were obtained by culturing for three days. These were then steeped in Tetramine saturated Tyrode's solution and recultured by feeding with Tetramine saturated embryo extract. No effect on the established fibrocytes could be demonstrated by this method. Fresh fragments of young rat heart were steeped in Tetramine saturated Tyrode's solution and then cultured with adherent Tetramine crystals. A significant inhibition of growth by this supersaturated preparation was obtained when compared with normal controls.

It was concluded that the alternative double coverslip method proved a worthwhile addition to techniques. The hanging drop method is useful for testing drug toxicity, but may not always be conclusive in a small series. The serum vial syringe method of growing cells in agitated medium is soundly conceived, and merits a further trial when conditions are favorable for growing a suitable cell stock in adequate quantity. 64 pages. $2.00. Mic 57-3266

THE NEUROMUSCULAR ACTIVITY OF A SERIES OF BIS (3-HYDROXY DIMETHYL PIPERIDINIUM BROMIDE) ETHERS

(Publication No. 22,080)

Allan Leo Fisher, Ph.D.
State University of Iowa, 1957

Chairman: Professor Hugh H. Keasling

The neuromuscular blocking activity of a series of bis ethers of 3-hydroxy dimethyl piperidinium chloride containing 5,6,7,8,10,12 and 14 methylene groups has been studied via the mouse inclined screen (Thesleff, S. and Unna, K., J. Pharmacol. Exper. Therap. Vol. 111:99, 1954), the rat sciatic nerve-gastrocnemius muscle preparation (Van Maanen, E.F., J. Pharmacol. Exper. Therap. Vol. 100:362, 1950) and the hen sciatic nerve-gastrocnemius muscle preparation (Pelikan, E.W., Smith, C.H., and Unna, K.R., J. Pharmacol. Exper. Therap. Vol. 111:30, 1954). In all three preparations activity was maximal in the C-12 analogue. PD_{50}'s for this derivative were: mouse = 90 microgm./Kgm., rat - 140 microgm./Kgm. and the hen = 60 microgm./Kgm. The C-5 through C-10 analogues qualitatively resembled decamethonium, the C-14 analogue qualitatively resembled d-tubocurarine while the C-12 analogue produced contraction paralysis in the hen without contracture, and was not antagonized by edrophonium.

In the dog, the C-10 and C-12 analogues potentiated the depressor effect of acetylcholine. In the mouse neostigmine at 25 or 50 microgms./Kgm. given I.V. prior to the C-12 analogue did not influence the number of mice paralyzed at a PD_{75} dosage. At 100 microgm./Kgm. neostigmine increased the number paralyzed.

In the dog sciatic nerve-gastrocnemius muscle preparation (Zaimis, E., J. Physiol. Vol. 122:238, 1953) the C-12 analogue had an approximate PD_{50} of 80 microgm./Kgm. and was not antagonized by edrophonium.

29 pages. $2.00. Mic 57-3267

ISOTONIC SOLUTIONS. THE PERMEABILITY OF RED CORPUSCLES TO VARIOUS SUBSTANCES.

(Publication No. 22,236)

Thaddeus S. Grosicki, Ph.D.
The University of Florida, 1953

The hemolytic method was used to obtain data that would be of value in the preparation of isotonic solutions. In the experimental work the degree of hemolysis occurring in varying concentrations of several substances was determined. Per cent hemolysis was determined by obtaining readings in the colorimeter for 100 per. cent hemolysis in 0.1 per cent sodium carbonate solution and comparing these readings with those obtained in varying concentrations of a particular substance. The quantitative data obtained in this manner was then used to calculate the $\bar{i}$ values for these substances by the osmotic factor method. Most of the experiments were carried out with rabbit blood, however, a number of the experiments were repeated using human blood in order to determine whether

any relationship existed between the results obtained with rabbit blood and those obtained with human blood.

Any error due to variable erythrocyte fragility was minimized by determining the degree of hemolysis in varying concentrations of sodium chloride for each blood sample that was used in the course of the experimental work. A direct comparison between the degree of hemolysis occurring in a certain concentration of sodium chloride and some other solution was thus made possible.

The $\bar{i}$ values as calculated from hemolytic data obtained on rabbit erythrocytes for sodium acetate and sodium nitrate were approximately the same as for sodium chloride. In the case of the amino acids (Glycine, B-Alanine, dl-Alanine, dl-Isoleucine) and sugars (Dextrose, Sucrose, Lactose), the $\bar{i}$ values obtained with rabbit erythrocytes for these substances were approximately 1.20. The higher $\bar{i}$ values for these substances are apparently due to a change in the permeability of the corpuscular membrane, resulting in electrolyte loss from within the cell. In solutions containing sodium chloride and varying concentrations of amino acids the $\bar{i}$ values were approximately one. No change in the $\bar{i}$ values for the sugars was obtained in solution containing sodium chloride and varying concentrations of the sugars. Restoration of normal permeability of the corpuscular membrane apparently takes place on addition of sodium chloride in the case of amino acids but not in the case of sugars.

In experiments with human erythrocytes the results obtained with amino acids were similar to those obtained with rabbit blood. In solutions of dextrose alone the average $\bar{i}$ value for dextrose was 1.18, as compared to 0.67 in solutions of dextrose containing sodium chloride. In the former case, leakage of electrolytes from within the cell seems to account for the higher i value. In the presence of sodium chloride normal erythrocyte permeability seems to be restored preventing the loss of electrolytes but allowing some penetration by dextrose. As a result of dextrose penetration it appears that the blood is in equilibrium with a higher concentration of dextrose than would be the case if no penetration occurred, thus giving an apparently lower $\bar{i}$ value.

The results presented here indicate permeability of the human erythrocyte for dextrose but not for the amino acids used in this investigation. The fact that the present work indicates impermeability of the human erythrocytes for amino acids as compared to the slow permeability reported by other investigators might be explained as being due to differences in techniques. The results show that rabbit erythrocytes are impermeable to amino acids and to the sugars, dextrose, sucrose, and lactose and agree fairly closely with results reported by other workers.

178 pages. $2.35. Mic 57-3268

THE EFFECTS OF CERTAIN CENTRAL NERVOUS SYSTEM DEPRESSANTS ON THE MOTOR ACTIVITY OF ALBINO MICE

(Publication No. 22,264)

William James Kinnard, Jr., Ph.D.
Purdue University, 1957

Major Professor: Dr. C. Jelleff Carr

Adequate methods are not available for appraising the subtle central nervous system effects of the ataractic agents. The usefulness of certain of these drugs in medicinal practice indicated the necessity for quantitative evaluating measures in order that better drugs might be discovered. Present methods, that yield satisfactory results, encompass complicated techniques for the measurement of the tranquilizing effect in laboratory animals. A definite need has been established for a simple, preliminary test for the differentiation between the types of central nervous system depressants. The purpose of this study was to attempt to develop such a screening technique.

A series of tests was conducted to determine the antagonistic effect of certain ataractic agents on central nervous system stimulation. The ataraxics were tested against amphetamine stimulation in chicks, chlorophenothane (DDT) convulsions in rats, and morphine stimulation in mice, These tests did not fulfill the requirements for satisfactory evaluation of these drugs.

A set of photocell activity cages were built. In these cages the activity of the mice is recorded by the number of times an animal interrupts a light beam, focused on a photoelectric cell. The effect of chlorpromazine hydrochloride, amobarbital sodium, secobarbital sodium, 2-ethylcrotonylurea, and meprobamate on the activity of mice was determined using the photocell method. The effect of chlorpromazine hydrochloride, amobartital sodium, and 2-ethylcrotonylurea on the activity of amphetamine stimulated mice was also determined.

A retarod was constructed. The instrument permits the determination of the coordinated motor activity of mice by measuring the length of time the animals could walk on a turning rod. The drugs tested in the photocell study were also evaluated by the rotarod method. The antagonistic effect of sodium succinate on the central nervous system depressants was also studied using the rotarod.

Activity ratios for these drugs were determined for the two test methods. These ratios were obtained by dividing the experimental means by the control values. The control figure is thus assigned a ratio value of 1.00. The ratios were plotted and the resulting activity patterns were compared.

The photocell activity cage measured the motor activity of the test animals. It would measure the degree of depression, but not the type of depression. The use of the rotarod allowed differentiation of the types of depression. The animals must have coordinated motor ability to remain on the apparatus. The combination of the two methods gave an adequate screening procedure.

The barbiturates, in certain doses in mice, gave evidence of a "normal" activity pattern, in the photocell activity cage; however, the rotarod method showed that no coordinated motor activity was possible in these animals. The compound, 2-ethylcrotonylurea, caused a moderate

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degree of sedation in the mice, as measured by the photocell method. Animals under the influence of the same dosage of the drug were capable of normal activity when they are forced to perform on the rotarod. Chlorpromazine elicited a response that was intermediate between the results obtained with the barbiturates and 2-ethylcrotonylurea. Meprobamate elicited patterns similar to the barbiturates; however, the skeletal muscle relaxant action of this drug modifies its activity pattern.

Sodium succinate has been shown to be an antagonist to the central nervous system depressant action of amobarbital sodium, secobarbital sodium, and meprobamate, when measured by the coordinated motor activity performance test of the rotarod. The antagonism of meprobamate depression by sodium succinate required further study. It is possible that the mechanism of action of meprobamate and the barbiturates might be clarified by such studies.

The photocell activity cage and the ratarod studies, when combined, yield a suitable simple screening technique for evaluating central nervous system depressants.

111 pages. $2.00. Mic 57-3269

THE METABOLISM OF GLYCOLIC ACID-1-C^{14} IN RAT LIVER PREPARATIONS

(Publication No. 21,304)

Frank Dennis O'Connell, Ph.D.
Purdue University, 1957

Major Professors: Egil Ramstad and John E. Christian

This work was undertaken to ascertain the possibility for the reduction of glycolic acid to acetic acid through the medium of coenzyme-A complexes and the possible utilization of the acetic acid for lipid synthesis or for other reactions involving acetate.

A survey of the literature revealed other possible routes for the entrance of glycolate carbon into lipids. During the present work, these routes were also investigated.

The medium chosen to study the reactions of glycolic acid was rat liver preparations, both homogenates and slices.

In rat-liver homogenates, no evidence was found of the occurrence of coenzyme-A complexes as intermediates in glycolic acid reduction, and no evidence of such a reduction was seen.

Under the conditions used, in homogenates, glycolic acid was not converted to detectable amounts of ethanolamine.

In confirmation of the results of previous workers, several reactions were noted involving glycolic acid and its metabolic products. Glycolic acid was found to be converted to glycine and a small amount of serine. Glycolic acid was not oxidized to oxalate.

In preparations of liver slices, the addition of glycolic acid-1-C^{14}, coenzyme-A, and sulfanilamide, to act as a glycolyl acceptor, caused the production of several labelled compounds. These same compounds were absent from a control preparation of slices which contained glycolic acid alone.

The one compound which appeared in a sufficient quantity was taken for further study. After two-dimensional chromatography of the substance, it was found to be resolved into two compounds.

One of these compounds was acidic in character, and yielded glycolic acid upon hydrolysis.

Hydrolysis studies on the other compound indicate that, most likely, it is glycolylsulfanilamide.

98 pages. $2.00. Mic 57-3270

THE EFFECT OF CERTAIN CARCINOGENIC AGENTS ON THE TOTAL NON-PROTEIN SULFHYDRYL CONTENT OF THE RAT LIVER

(Publication No. 22,292)

Pierre-Georges Roy, Ph.D.
Purdue University, 1957

Major Professor: Dr. C. Jelleff Carr

The effect of the carcinogenic agents p-Dimethylaminoazobenzene (DAB) and B-Naphthylamine (BNA) on the total non-protein sulfhydryl content (TNPSH) of the rat liver has been investigated.

These experiments indicate that fasting alone (20-24 hours) had very little effect on the TNPSH content of the rat liver. From acute experiments, it was found that DAB, administered up to 50 mg./Kg., failed to produce any significant decrease in the sulfhydryl level, whereas BNA, given at a dose of either 10 mg. or 20 mg./Kg., induced a significant and similar drop in the TNPSH concentration. A dose of 5 mg./Kg. of BNA was without any effect.

The results, from the chronic experiments, revealed that the TNPSH level of the stock diet fed rats remained relatively constant throughout the experiment. The low protein-low riboflavin diet fed rats showed a decrease after 12 weeks but the liver TNPSH values returned to near normal in 16 weeks. There is also indication that the addition of 600 mg. of DAB or 100 mg. of BNA per 1 Kg. of diet decreased the sulfhydryl concentration of the rat liver. The incorporation of BNA to a non-protective diet caused a maximum drop after 4 weeks. Under the same experimental conditions, the effect of DAB was quite marked after 8 weeks, with very little variations at the end of 16 weeks.

These carcinogens, when added to the stock diet, likewise decreased the liver sulfhydryl level. In this instance, both DAB and BNA induced their maximum lowering after 12 weeks, with a gradual return to normal values at the 20th week.

No symptoms of toxicity or gross pathology of the pancreas, bladders and adrenals were observed after DAB and BNA treatment. A few cases of enlarged spleens and kidneys were noticed at the time of sacrifice. The most severe gross changes occurred in the livers of the low protein-DAB fed rats.

No significant histopathological changes were detected in the pancreas, spleens, adrenals, kidneys and bladders of the experimental animals. The incorporation of DAB to a low protein-low riboflavin diet induced the most extensive hepatic changes after 16 weeks of treatment. These abnormalities consisted mainly of large areas of degenerated parenchymal cells in contrast to areas of normal

parenchyma. Groups of large cells with hyperchromatic nuclei, suggestive of neoplastic cells, were also observed.

The results point out that it was difficult to determine any definite development of new cells in the livers of the BNA treated rats at any time.

This investigation suggests that the sulfhydryl depletion, which takes place under such experimental conditions, may be involved in either the detoxification mechanism, the process of carcinogenesis, or both.

93 pages. $2.00. Mic 57-3271

THYROID ACTIVITY IN SELECTED STRAINS OF MICE

(Publication No. 22,305)

Arthur Albert Wykes, Ph.D.
Purdue University, 1957

Co-Major Professors: John E. Christian and
Frederick N. Andrews

The principle objective of the research reported was to investigate the relationship of strain differences to thyroid activity differences in three strains of mice – the obese hyperglycemic (ob) strain, the dwarf (dw) strain, and the Rockland Swiss strain.

The experimental work was designed to disclose significant differences or similarities in the data on thyroid weight, body weight, and uptake of I-131 by the thyroid from the three strains of mice. Comparisons of the data were made between sexes in each strain, between like sexes of different strains, between opposite sexes of different strains, and between like sexes of the same or different strains, when phenotypically obese mice were compared with phenotypically normal mice, or phenotypically dwarf mice were compared with phenotypically normal mice.

Statistical calculations were employed to indicate the reliability of the data and to indicate the relationship of thyroid weight to body weight, per cent of I-131 uptake per gm. body weight, and per cent of I-131 uptake per mg. thyroid weight for the three strains of mice.

In addition, it was of interest to compare thyroid weight, body weight, and per cent of I-131 uptake data from goldthioglucose-obese mice with like data from non-obese control animals.

Most of the data were collected from mice 8 to 10 weeks in age under comparable experimental conditions. All the mice were fed a commercial poultry ration ad libitum, containing adequate nutrients and 0.235 γ of iodine per gm. Heterozygous breeding pairs were used as much as possible when breeding the obese (ob) and dwarf (dw) strain mice. After weaning, litters were kept by sexes until 8 to 10 weeks of age. The breeding room was air-conditioned during the warm months of the year (mean temperature 75° F).

Thyroid activities of the mice were determined by the thyroidal uptake of aqueous solutions of 0.5 μc. or 1.0 μc. of carrier-free I-131 in 5 hours following intraperitoneal injections. Thyroid glands were removed free of extraneour tissue or with small sections of trachea tissue attached. (Errors due to I-131 in trachea tissue and blood were insignificant.)

Thyroid glands, other tissues and aqueous standard solutions containing I-131 were counted by the scintillation method with the RIDL Model 230 Scintillation Spectrometer. The differential method of counting I-131 at the 0.364 Mev. gamma-emission peak was used throughout the study. Geometry of sample conditions were very good and counting errors low (<1.0 per cent). Iodine-131 activities counted in the samples were related per centage-wise to I-131 activities counted in aqueous solutions representing dosages of I-131 injected.

All the data were collected during a twelve-month period. No definite seasonal variations in the uptake of I-131 by the thyroids of the three strains of mice were evident.

Data indicated highly significant differences ($P < 0.01$) and similarities existed between the three strains of mice with respect to body weight and thyroid weight data. The significant differences ($P < 0.01$) in the thyroidal uptake of I-131 were limited to significant differences between the female mice of the three strains.

The data on thyroid weight and per cent of uptake of I-131 by thyroid glands of the three strains did not indicate a clear-cut relationship between thyroid weights and per cent of uptake of I-131. However, data on the per cent of thyroid weight to body weight were nearly similar in all the mice with the exception of the phenotypically obese mice of the obese strain. Thyroid weights of phenotypically dwarf mice could not be determined.

Body weights and thyroid weights of female mice of the three strains tended to be lower than for corresponding males of the same strain. Body weights of phenotypically-obese mice of both sexes, as expected, were much heavier ($P < 0.01$) than phenotypically normal mice. Data on the body weights of phenotypically normal obese strain mice and phenotypically normal dwarf strain mice showed a surprising similarity in body size. Phenotypically dwarf mice, as expected, were significantly smaller than any other mice of any other group ($P < 0.01$).

Data on the per cent uptake of I-131 per gm. of body weight pointed to an inverse relationship to body weight in all of the mice.

Thyroid activity in the phenotypically obese mice was not significantly different from thyroid activity in the phenotypically normal mice of the obese strain. Thyroid activity appeared to bear no relationship to the "metabolic type" obesity found in the former phenotype.

LD_{50} doses of goldthioglucose did not change normal thyroid weight nor alter normal thyroid activity in goldthioglucose-obese mice. Changes in thyroid function did not appear to be involved in the "regulatory-type" obesity of goldthioglucose-obese mice.

The data gave no indication of a bodily dilution of I-131 by lipid tissues in goldthioglucose-obese mice, or in phenotypically obese mice.

There were no indications of a hypothyroid condition in any of the mice with the exception of the phenotypically dwarf mice.

In general there were highly significant differences, (< 0.01), in body weights and thyroid weights within and between the three strains of mice which were not paralleled by significant differences in the thyroidal uptake of I-131.

277 pages. $3.60. Mic 57-3272

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

THE RELATION BETWEEN LOGIC AND ONTOLOGY: WITH SPECIAL REFERENCE TO MORRIS R. COHEN

(Publication No. 22,462)

Robert Edwin Larsen, Ph.D.
University of Minnesota, 1957

Adviser: Paul L. Holmer

This thesis is an investigation of four logical theories, particularly with reference to what they assert concerning the relation between logic and ontology. The four theories are: idealism, pragmatism, positivism, and the Aristotelianism of Cohen.

Idealism contends that reality is sentient experience, and that knowledge is "constructed" reality based on sentient experience. Constructed reality is private; each man constructs his own knowledge structure by interpreting, through judgement and inference, sentient experience. The laws of construction are not private, however, but are the necessary principles for interpreting sentient experience. These principles are the descriptive and prescriptive laws of logic. However, it is argued that the claim that the laws of construction are objective and public rests on mere dogmatic assertion. The idealist identification of implication and causality rests on a faulty analysis of implication. The faulty analysis of implication results from concentrating on inference rather than implication. This, in turn, results from idealism's denial that logic is formal.

Dewey also denies that logic is formal. His chief concern is to develop a logic of discovery. Lack of adjustment between a man and his environment gives rise to a problematic situation which must be resolved. The habits men develop to guide their resolution of problematic situations become logical principles. Dewey sees logic as the empirical theory of such habitual behavior. He denies that logic is concerned merely with the exposition of the results of inquiry, and he rejects all attempts to establish a metaphysical ground for logical rules. It is argued that Dewey is mistaken in denying that logic is formal and in claiming that logic's proper concern is discovery.

Carnap contends that logic is a completely formal, linguistic discipline. The philosophical theory of language is semiotic, and consists of three divisions, pragmatics, semantics, and syntax. Pragmatics is the descriptive study of words, their designata, and their users. Semantics neglects the user and studies only words and their designata. Syntax studies only words or formulae for words. If semantics and syntax are based on pragmatics, they are "descriptive." However, they may be non-descriptive or "pure" studies. Pure semantics and syntax rest on arbitrary definitions. If a syntax (logic) is constructed without attention to descriptive semiotic, it is useful rather than true (or false). If, however, a syntax is based on descriptive semiotic, then the syntax is true (or false); it is ontological in the sense that it corresponds to actual linguistic usage. It is argued in the thesis that only the latter procedure can yield a logical system. Furthermore, even pure syntax is constructed in accordance with such ontological principles as the laws of thought.

Cohen believes logic is formal but not completely formal. The logician, in discovering implications, neglects the particular meaning of propositions. In this sense logic is formal. However, neglect of particular meaning does not imply that there is no reference to fact. Absence of specific meaning does not mean total absence of meaning. In this sense logic is not completely formal. Since logic thus involves meaning, and since meaning is taken, by Cohen, to be a part of ontology, logic is ontological. Implications between propositions express implications between objects.

The thesis concludes that Cohen's insight is sound. Idealism is mistaken in stating that ontology is a private mental construction. Pragmatism and positivism are mistaken in denying that logic is ontological. Habits are ontological, and language refers to the ontological order. However, Cohen's claim cannot be argued. It is the presupposition of inference, and therefore cannot be defended by making inferences. 336 pages. $4.30. Mic 57-3273

THE METAPHYSICS OF RĀMĀNUJA AND BOWNE

(Publication No. 21,409)

Frederick Kumar Lazarus, Ph.D.
Boston University Graduate School, 1957

Major Professor: Professor Peter A. Bertocci

This dissertation is a comparative study of the metaphysics of Rāmānuja and Bowne. The following points summarize the positive results of the investigation.

1. Both thinkers shy away from everything abstract in their philosophic heritage and concentrate on those ideas of their predecessors which emphasize the centrality of the self.

2. They are concerned to do justice to experience in all its aspects, and to this end they employ a method which may generally be characterized as synoptic.

3. In their epistemologies both thinkers hold that knowledge, if it is to be trusted, must be provided with a metaphysical ground, so that the theory of knowledge for them is closely related to the theory of being. In the last analysis it is God who is the guarantor of the possibility of knowledge, just as God's unfolding in the world is the basis of the dynamic character of knowledge. In Bowne the point is expressed in his insistence that human knowledge is not a passive reflection of the world, but involves an activity underlying which is the divine activity. To Rāmānuja all finite knowledge depends on a passage from the indeterminate to the determinate, an activity which distinguishes as it unites, and both the

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distinctions and the unity are expressions of the divine mind in the process of its unfolding.

4. The two philosophers agree that the starting point of natural knowledge is sense experience, and agree further that at the sense level, as at all other levels, mind or consciousness is the constitutive principle. With regard to what is involved in the cognitive relation, they are at variance, Rāmānuja appearing to hold a presentative theory and Bowne a representative theory. For both philosophers the self is fundamental not only metaphysically but epistemologically.

5. In their metaphysics the two thinkers are agreed in their rejection of the idea of pure being as an empty abstraction. They insist that being is not an inert substance, but a process of activity. Being is causal, a system of dynamic relationships. Most significantly of all, both thinkers conceive of being as a conscious subject.

6. Central to Rāmānuja's and Bowne's conception of the world is the notion of the self. They emphasize the self as knower, and agree that the self is the basis of the unity of knowledge. They also ascribe causal agency to the self, and insist that, while the finite self is within the comprehension of the supreme self, it is yet autonomous and free.

7. For Rāmānuja as well as Bowne, the world comes into being as a result of the activity of God. Further, they agree that the will of God continuously manifests itself in the world, and that the world is under His constant superintendence. What transpires in the world can only be understood in terms of a divine plan and purpose. Indeed, it is this teleological character of the world which is its most pervasive and deepest feature.

8. The differences between Rāmānuja and Bowne are as follows: In contrast to Bowne's epistemological dualism, Rāmānuja holds to a presentative theory according to which what we know are not mental surrogates which stand for the objects known, but the objects themselves. Further, while agreeing with Bowne that the mind contributes categories of its own to knowledge of the object, Rāmānuja assigns, as Bowne does not, ontological status to space and time. Again, unlike Bowne, who takes an empirical view of the self, Rāmānuja's view may be characterized as mystical, that is, he does not emphasize as Bowne does the substantial otherness of the self from the infinite. Finally, the freedom, which both thinkers are concerned to emphasize, is for Rāmānuja not so much freedom of the will as the freedom of consciousness.

488 pages. $6.20. Mic 57-3274

THE JUSTIFICATION OF LEGAL PUNISHMENT

(Publication No. 22,205)

Edmund Lloyd Pincoffs, Ph.D.
Cornell University, 1957

The answers which have been given to the question how punishment is morally justified fall traditionally into one of two categories: the retributivist or the utilitarian. The retributivist says that it is only because of what the criminal has done that he ought to be punished. The utilitarian holds that it is only the expectation of good results, such as deterrence of the criminal or others or reform of the criminal, which makes punishment morally respectable. Modern treatises on punishment have consisted mainly in attempts to reconcile these two conflicting views.

So long as no distinction is made between the sorts of discussion involved in "the" justification of punishment, no reconciliation of the main views is possible. A close examination of the two traditional positions reveals that they are quite incompatible. The utilitarian (Plato, Hobbes, Bentham, Mill) maintains that the production of good results is both a necessary and a sufficient condition of the justification of punishment. The retributivist (Kant, Hegel, Bradley) maintains that both necessary and sufficient conditions for the justification of punishment are present when the person in question has committed a crime. And the question how much punishment is justified must also be settled by reference solely to utilitarian or solely to retributive considerations.

The incompatibility of the traditional views on punishment is confirmed by consideration of the arguments which have been, and may be, adduced on each side. The result of the dispute is an impasse, on each side of which may be found intelligent and well-informed men.

The impasse results from treating "the" question of punishment as if it were one unambiguous question. There are a variety of kinds of discussion which may be taking place when the justification of punishment is at issue. There are judicial and legislative discussions of several types, and there are the discussions which take place when the institution of punishment is itself challenged. These varieties of discussions about punishment are examined in separate chapters. It is by choosing paradigms of discussion from one of these areas to the exclusion of the others that incompatible views are made to seem so plausible.

The institution of punishment is challenged either on utilitarian grounds or because it is held to be inherently unjust. The main reason punishment is held to be unjust is that law violators are not really responsible for their crimes. This position has been put forward by a variety of sociologists, psychologists, psychiatrists, and criminologists. An important intellectual predecessor of this movement is Robert Owen, the British Socialist.

The contention that criminals are not responsible for their crimes and therefore should not be punished, is not an intelligible one. While we can understand the position that a particular man is not responsible for his crime, because he comes under a recognized head of exception, such as insanity or accident; it is not so clear what is being said when it is asserted that no men who commit crimes are responsible.

The institution of legal punishment may be defended by showing that (granting some very general facts of nature, human nature, and human society) some regulation of human affairs is necessary, and some "device" must be found for making these regulations effective (the "guiding principle" of justification). Of the "devices" available, the most efficient is legal punishment. And punishment may be accepted because it does not, as such, violate any of our strongly held values (the "limiting principles" of justification).

192 pages. $2.50. Mic 57-3275

PHYSICS, GENERAL

OPTICAL AND ELECTRICAL PROPERTIES OF SILVER CHLORIDE

(Publication No. 20,193)

Peter Glover Aline, Ph.D.
University of Oregon, 1957

Adviser: F. E. Dart

Simultaneous measurements of absorption, fluorescence, and photoconductivity have been investigated for AgCl as functions of exciting radiation and temperature. Excitation in the range of 250 to 400 millimicrons with temperatures from -180°C to room temperature were employed. Frequency-sensitive apparatus was used throughout the measurements with the light beam chopped at 37.5 cps. An ac electrometer circuit was employed to measure currents in the range 10^{-16} to 10^{-11} ampere.

The temperature dependence of the absorption edge has been extended to lower temperatures and the coefficient of absorption observed to be an exponential function of wavelength. It was also observed to be an exponential function of $1/T^{0}K$ in the range 387 to 400 millimicrons. The fluorescence of AgCl at -175°C was 482 millimicrons for an exciting wavelength in the region of 270 millimicrons. A second weaker fluorescence peak of undetermined wavelength was observed at temperatures in the neighborhood of -150°C for an exciting radiation of 390 millimicrons. Photocurrents proportional to the intensity of the exciting radiation were observed in the saturation current region for low applied voltages. Photoconductivity was observed in each of two different regions of the temperature range and wavelength range of exciting radiation employed. There were large photocurrents for wavelengths of exciting radiation less than 270 millimicrons in the temperature region of -175° C and smaller photocurrents at temperatures of -55° C for exciting radiation of 398 millimicrons. The spectral distribution of photoconductivity was also investigated. 109 pages. $2.00. Mic 57-3276

CRYSTAL GROWTH AND ELECTRICAL AND OPTICAL PROPERTIES OF GRAY TIN

(Publication No. 22,193)

James Hall Becker, Ph.D.
Cornell University, 1957

The linear rate of transformation of white to gray tin, the time for nucleation, and the preparation of samples suitable for electrical and optical experiments were studied. High purity tin, as well as tin with specific impurities added, was investigated under many conditions. These include temperatures between 5 and -112° C, various sample dimensions and bonding to a substrate, as well as thermal and mechanical treatments.

These studies demonstrate that it is possible to prepare gray tin as single crystalline or slightly polycrystalline bulk samples, as well as in thin films. High temperatures of transformation, thin narrow specimens, and the addition of specific impurities yielded the best crystals.

The linear rates of transformation were sensitive to temperature and impurity content. The maximum rates occurred near -30° C and values of 2mm/hr and 7×10^{-3} mm/hr were measured on samples with only slight differences in impurity content. Bonding of thin films to a substrate greatly reduced the rate. It was unchanged by annealing or cold work. The time for nucleation was sensitive to these factors.

Absolute rate theory is presented which qualitatively explains many of the observed phenomena. The heat of activation for the white to gray tin transformation is not sensitive to impurity content and is calculated as $(8{,}7 \pm 1.5) \times 10^{3}$ cal/mole(at 0° K).

The Hall coefficient, electrical conductivity and their magnetic field dependence were studied on n- and p-type samples with extrinsic concentrations of carriers between 2×10^{16} and 2×10^{17}/cc, and 3×10^{17} and 5×10^{18}/cc, respectively. Temperatures from 286 to 5° K and magnetic fields between 100 and 5060 gauss were used.

In the high purity materials, temperatures as low as 20° K were necessary to obtain extrinsic properties. Intrinsic values of the Hall coefficient and electrical conductivity at 0° C are 0.21 ± 0.05 cm^3/clb and $(1.8 \pm 0.4) \times 10^{3}$ ohm^{-1} cm^{-1}, respectively. Electron mobilities of 80×10^{3} cm^2/volt-sec. were measured at 80° K; even larger lattice scattering mobilities are predicted. The forbidden band gap at 0° K obtained from the electrical conductivity is 0.10 - 0.14 e.v.; similar values and as large as 0.22 e.v. can be obtained from the Hall coefficient.

Small values for the ratio of longitudinal to transverse magnetoresistance indicate that the conduction band is nearly spherical and that the valence band(s) may be slightly anisotropic.

The magnetic field dependence of the Hall coefficient and electrical conductivity is examined for systems of electrons and "fast" and "slow" holes which experience mixed ion-lattice scattering; the possible presence of "fast" holes in gray tin is discussed.

Preliminary photoconductivity studies at 78 and 4° K indicate a forbidden band gap of 0.075 ± 0.005 e.v.. No transmission of 2 to 35 micron radiation was observed for thin films at these temperatures. This is not inconsistent with absorption due to free carriers with an effective mass the order of 0.01 times the electron mass.

The measurements of the energy band structure are in agreement with theoretical predictions.

267 pages. $3.45. Mic 57-3277

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ON THE QUANTIZATION OF INTERACTING EINSTEIN, MAXWELL, AND DIRAC FIELDS

(Publication No. 22,250)

Davis Isaac Caplan, Ph.D.
Purdue University, 1957

Major Professor: F. J. Belinfante

An "Augmented Theory" of interacting Einstein, Dirac, and Maxwell fields is developed in which extra terms are introduced into the Lagrangian to remove inconsistencies between constraints and commutation relations. A transformation for the field variables is explicitly given, which removes the problem of the "second-class" constraints. The first-class constraints are replaced by auxiliary conditions on the state vector, and these conditions are shown to be self-consistent and simply related to the primary constraints. Explicit solutions for the field velocities are given, which is not possible without the "augmenting" terms in the Lagrangian. The covariance of this theory is discussed, and it is shown to be covariant in a certain sense.

Finally, the possibility of a quantization of the theory without "redundant" variables and "augmenting" terms in the Lagrangian is discussed and shown to contain serious difficulties. 71 pages. $2.00. Mic 57-3278

LIQUID CONTENT AND CONDUCTIVITY OF SOILS USING VOLUMETRIC PRESSURE PLATES

(Publication No. 22,340)

David Emerson Elrick, Ph.D.
The University of Wisconsin, 1957

Supervisors: Associate Professor Champ B. Tanner, and Associate Professor Edward E. Miller

The liquid content and capillary conductivity of porous media exhibit hysteresis in their dependence upon the liquid pressure. The hysteresis phenomena in soils can be quite large and a knowledge of its extent and mechanism is important to understanding many soilwater relationships.

A physical theory for capillary flow has been developed by E. E. and R. D. Miller in which hysteresis effects are predicted by the mathematical development. The purpose of the present research was to determine hysteresis of the liquid content vs. pressure relation for two pure liquids in the same soil using this theory to establish identical reduced pressure cycles and to appraise the results.

A pressure plate apparatus was developed which would give the liquid content of the same medium at various pressures by allowing measurement of the volume discharge or uptake of liquid by the medium between specified pressures. Errors through liquid losses were minimized. In addition on applying a step change in pressure, the volume discharge or uptake of liquid could be measured as a function of time. A theoretical calculation extending the transient-outflow method of W. R. Gardner allowed use of this outflow data for determination of the capillary conductivity.

Three media, an alundum mixture (sand-sized particles), organic free Spencer silt loam with clay and the same without clay (<5 μ particles removed) were used. The two liquids were water and butyl alcohol having surface tensions and viscosities differing by factors of 3.0 and 2.9 respectively.

The results of this investigation are as follows:

(1) Two pressure cycles were tried with the alundum mixture and reproducible cycles were obtained after the initial release.

(2) The water and butyl alcohol contents of the alundum mixture during both release and uptake of liquid (excluding the initial release curve) were found to be the same when plotted as a function of reduced pressure; thus the scaling predicted by the theory is confirmed within the limitations of the experiment.

(3) The experiments with Spencer with and without clay indicate that the water and butyl alcohol contents vs. reduced pressure do not scale well. A portion but not all of this discrepancy may be due to the unknown changes in bulk volume due to packing under tension.

(4) Good scaling of the capillary conductivity measurements was obtained for the one determination tried. This was done at relatively low water and butyl alcohol contents of the alundum mixture. 57 pages. $2.00. Mic 57-3279

THE EFFECT OF CRYSTAL STRUCTURE ON THE INTERMEDIATE STATE OF ONE MILLIMETER SUPERCONDUCTING TIN SPHERES

(Publication No. 22,343)

Thomas Lassfolk Finch, Ph.D.
The University of Wisconsin, 1957

Supervisor: Associate Professor Joseph R. Dillinger

The purpose of this investigation was to obtain information concerning the behavior of an electrical superconductor in the intermediate state. This was done by measuring the magnetic moment of small superconducting tin spheres as a function of applied magnetic field.

The apparatus consisted of a cryostat in which the spherical tin sample was immersed in liquid helium with provisions for moving it between two "pickup" coils in a direction parallel to the applied magnetic field. Thus, the magnetic moment of the spherical sample induced an e.m.f. in the coils when it was moved between them in a periodic fashion by a motor-driven crank. A small "bucking coil" was wound around the sample and moved with it. By passing a current through this bucking coil to create a magnetic moment equal and opposite to that of the sample, the e.m.f. in the pickup coils was minimized. The current in the bucking coil under this condition was proportional to the magnetic moment of the sample. The magnetization curves which were determined were presented as plots of sample magnetic moment as a function of applied field for constant temperatures.

Measurements were made on many samples in different crystalline states, ranging from extremely polycrystalline ones to some which were very nearly monocrystalline. The measurements were made at 3.5°K and 3.0°K. Approximate values of the surface energy of the normal-superconducting interface within tin were calculated from

the curves. Models given by Landau, Andrew, and Kuper were used for these calculations.

It was found that the monocrystalline samples showed a curve which indicated that the superconducting state persisted for values of applied field considerably above 2/3 of the critical field, then underwent a sudden transition into the intermediate state. This behavior is characterized by a horn-like feature on the magnetization curve, and is predicted by the accepted theories. On the other hand, the polycrystalline spheres did not show this behavior, and indicated that the intermediate state is established gradually. The values for the surface energy which were obtained from the curves for the monocrystalline samples agreed in order of magnitude with values given by other workers. This was true for both the values obtained from the overshoot or "horn" of the curve, and for the values obtained from the slope of the curve in the intermediate state region. The data for the polycrystalline samples, however, while yielding comparable values from the slopes of the curves, gave much lower surface energy values from the calculations using the "horn" values. Since these curves showed no real discontinuities, the "horn" values were taken to be those points where the magnetization curve began to descend rapidly indicating an onset of the intermediate state. Thus, the establishment of the normal-superconducting boundaries between the domains which exist in the intermediate state seems to require less energy per unit interface area in polycrystalline metal than in a single crystal, while the growth of these boundaries involves as much surface energy as in a monocrystal.

These findings lead to the conclusion that crystal structure plays an important role in determining the manner in which a superconductor enters into the intermediate state.

163 pages. $2.15. Mic 57-3280

ACOUSTIC ABSORPTION AND CHEMICAL COMPRESSIBILITY IN A MAGNESIUM SULFATE SOLUTION

(Publication No. 22,162)

Frederick Hendrick Fisher, Ph.D.
University of Washington, 1957

It is known that nearly all liquids absorb more sound than can be accounted for theoretically on the classical basis of shear viscosity and heat conduction. Interest in chemical sources of sound absorption was stimulated by the fact that the absorption of sound in sea water was about thirty times as great as that in fresh water in the frequency region of 100 kc and below. Other work has shown that the absorption was due to a low concentration of magnesium sulfate exhibiting a relaxation in the frequency region just above 100 kc and also, that the absorption was due to a pressure dependent chemical reaction. This kind of chemical reaction can be responsible for a unique physical property; the compressibility of the solution may depend on the rate of compression. Such a property gives rise to excess sound absorption and dispersion.

In much the same manner that chemists vary the temperature to study chemical reactions the object of this work was to investigate the absorption mechanism by studying the absorption as a function of pressure up to high pressures.

A technique has been developed to measure the absorption of sound in liquids as a function of pressure in the frequency region of 100-500 kc. The following properties of a 0.5 molar solution of magnesium sulfate in water were measured up to 20,000 psi: absorption, relaxation frequency and velocity. From these data the chemical compressibility and the adiabatic compressibility were computed.

Calculations have been made to interpret the results on the basis of the dissociation reaction. To do so required calculations of the dissociation constant and the activity coefficient as functions of pressure. Some aspects of the dissociation theory which have been neglected are discussed.

92 pages. $2.00. Mic 57-3281

THE ATMOSPHERIC EFFECTS ON THE HARD COMPONENT OF COSMIC RADIATION NEAR SEA LEVEL

(Publication No. 22,131)

Walter R. French, Jr., Ph.D.
The University of Nebraska, 1957

Adviser: Robert L. Chasson

The atmospheric effects on the hard component of the cosmic-ray intensity were studied experimentally at Lincoln, Nebraska, using narrow- and wide-angle Geiger-counter telescopes with 20 cm. lead absorber. Cosmic-ray intensity measurements were made over a three-year period and calculations performed according to four atmospheric models. These were: 50 mb. Duperier, 100 mb. Duperier, 200 mb. Duperier, and Olbert analyses.

It is concluded that the 50 mb. Duperier model is superior to the others tested, but the extent to which the atmospheric effects can be eliminated is limited at present by the accuracy of the radiosonde data. Separate calculations for the 0300 GMT and 1500 GMT radiosonde flights gave different results. This is not necessarily evidence for diurnal cosmic-ray variations, however. Comparisons of results with those of other investigators show general agreement. The results of the present work are in good agreement with the theoretical temperature-effects work of Trefall, in poor agreement with his barometric-effects predictions, and do not substantiate the theoretical work of Olbert.

99 pages. $2.00. Mic 57-3282

ANALYSIS OF WATER BOILER REACTORS

(Publication No. 22,147)

Robert Haldin, Ph.D.
Unitersity of Utah, 1957

Chairman: Dr. T. J. Parmley

This report presents an analytical model relating the shutdown mechanism in water boiler reactors to the thermal expansion of the cross sectional area of the fuel plates. An equation is obtained relating the pressure gradient developed in the reactor core to the temperature

developed in the fuel plates. The constants in the equation are approximated and calculations for two power transients are presented. Numerical calculations based on the analytical model of this report give a change in moderator density much smaller than is necessary to shutdown the reactor.

Although the shutdown mechanism for water boiler reactors is attributed, mainly, to the formation of steam voids in the reactor core, there is some analytical insight to be gained by assuming that the expansion of the fuel plates introduces the shutdown mechanism.

In this report it is also assumed that the self-limitation of power transients is a result of steam voids produced in the moderator of the reactor core. A system of differential equations is presented which, is believed, will predict the kinetic response of water boiler reactors, provided sufficient heat transfer data is available.

48 pages. $2.00. Mic 57-3283

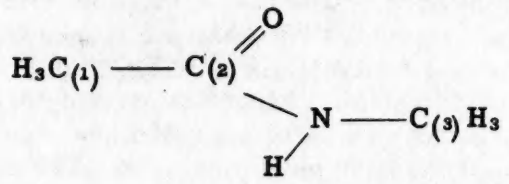
THE CRYSTAL STRUCTURE OF N-METHYLACETAMIDE

(Publication No. 22,657)

J. Lawrence Katz, Ph.D.
Polytechnic Institute of Brooklyn, 1957

Advisers: Benjamin Post and Isidor Fankuchen

The crystal structure of N-methylacetamide,



has been determined. N-methylacetamide melts at 28°C and undergoes a solid phase transition to a discorded form at about 10°C. The disordered form exists between this temperature and the melting point. The crystal structure determination was carried out using data obtained from precession and weissenberg photographs taken at $-35^{\circ}\pm5^{\circ}$C.

The unit cell at that temperature is orthorhombic, the space group is Pnma, and there are four molecules per unit cell. The unit cell dimensions are a = 9.61°A, b = 6.52°A, C = 7.24°A. The unit cell of the high temperature modification is also orthorhombic, the most probable space group is Pnmm and there are only two molecules per unit cell. The unit cell dimensions are a = 4.85°A, b = 6.59°A, c = 7.30°A.

Refined electron density maps of the low temperature modification indicate that the CCONC "residue" is planar within experimental error. Bond lengths and bond angles were computed from atomic positions obtained by least squares refinement. They are:

C_1-C_2 = 1.55$_0$°A, C_2-O = 1.23$_0$°A, C_2-N = 1.29$_3$°A, N-C_3 = 1.45$_7$°A and N-H—O = 2.83$_4$°A; the C_1-C_2-O bond angle is 120°, the C_1-C_2-N angle is 117°, the O-C_2-N angle is 123°, and the C_2-N-C_3 angle is 121°, The most probable errors in bond lengths are:

σ(C-C) = 0.015°A, σ(C-O) = 0.011°A, σ(C-N) = 0.012°A, and σ(N-H—O) = 0.008°A.

The molecules of N-methylacetamide are arranged in layers perpendicular to the "b" axis; the separation between layers is 3.26°A. The molecules in a layer are linked together by hydrogen bonds to form chains oriented approximately parallel to the "a" axis. These hydrogen bonds (N-H—O) are 2.83$_4$°A long. The long dimension of the molecule, i.e. the C-C-N-C group, is oriented at approximately 90° to the hydrogen bond direction. Van der Waal forces act between molecules in the "c" direction and between successive layers in the "b" direction.

Efforts have been made to determine temperature factors directly from measurements of changes of reflection intensities with temperature. The value obtained in this way for the (oko) temperature factor is in good agreement with that obtained in the usual manner during the structure determination. Similar measurements of the (001) reflections were inconclusive with respect to temperature factors; their intensities decreased with decrease in temperature. This effect is explained on the basis of a shift of the molecule in the "c" direction as temperature is lowered.

148 pages. $2.00. Mic 57-3284

THE CONSTRAINTS AND COMMUTATORS OF THE INTERACTING FIELDS OF ELECTRONS, ELECTROMAGNETISM AND GRAVITY

(Publication No. 22,263)

Warren Leslie Kennedy, Ph.D.
Purdue University, 1957

Major Professor: Frederik J. Belinfante

A generally covariant theory of the interacting fields of electrons, electromagnetism and gravity is considered. In this theory the gravitational field is specified by a so-called fourleg field, that is, in every world point we define the set of four orthogonal unit vectors, which form the four "legs" of the "fourleg" in that point and which determine the local Lorentz frame of reference, with respect to which components of spinors and undors can be taken. The invariances of the Lagrangian lead to "primary constraints," that is, identities between the canonical variables of the theory and their spatial derivatives. The definitions of canonical momenta may also lead to further identities. Consequently there are inconsistencies in the usual quantization procedure and the variables are not actually canonical. They can be made canonical on introducing new quantities η^{K} into the definitions of the canonical momenta. The constraint functions are shown to be obtainable from these quantities.

The usual correspondence between Poisson Brackets and (anti)commutators cannot be made on account of the fact that some of the constraint functions do not (anti)commute with each other. The modified Poisson Bracket of Dirac is introduced to take care of these constraint functions.

We can then make a correspondence between these modified P.B.'s and (anti)commutators. Secondary constraint functions result since the gauge and coordinate constraint functions are valid at all times.

The complete set of these primary and secondary constraint functions is shown to be self-consistent and to lead to no further secondary constraints.

134 pages. $2.00. Mic 57-3285

LARGE AMPLITUDE VIBRATIONS OF A ONE DIMENSIONAL GAS

(Publication No. 21,763)

Henry C. Kessler, Jr., Ph.D.
New York University, 1957

Adviser: Fritz Reiche

A survey is made of the possibilities of perturbation analysis for the study of one dimensional acoustic waves of finite amplitude. A review of the method of Lamb, in which a perturbation procedure is applied to the differential equation for the particle displacement, is first presented. It is shown that although this approach is well adapted to problems involving piston type boundary conditions, for certain other types of problems a perturbation method set up in terms of the velocity potential rather than the particle displacement is preferable. Such a method is developed partly through analogy with an analysis, due to Prandtl, of steady compressible flow in two dimensions. The method is applied to the problems of wave propagation in long tubes and the vibrations in a tube closed at both ends. It is shown that the method can be used in problems involving piston type boundary conditions, but, for such problems it is awkward compared to the Lamb method.

The solution to the problem of the vibrations in a tube closed at both ends is obtained by means of the finite Fourier transform. This technique seems to be well suited to the solution of large amplitude wave problems by the perturbation method, and can be used with the Lamb method as well as the Prandtl method. This is demonstrated by solving the problem of the wave motion in a tube driven by a vibrating piston at one end and closed at the other in the Lamb formulation.

A modification of the Prandtl method is presented which permits an estimate of the relative orders of magnitude of the terms produced by successive approximations to be made. The modification consists of redeveloping the perturbation procedure by expansion of the potential in powers of some parameter known to be small in a given problem. This modified Prandtl method is applied to the case of a progressive wave having an initially sinusoidal distribution of velocity. The calculation is carried to the third approximation, and a comparison is made with the exact solution of the same problem, obtained by means of the Poisson relation for simple waves and a special Kapteyn series. 93 pages. $2.00. Mic 57-3286

THE CRYSTAL STRUCTURE OF THIANTHRENE ($C_{12}H_8S_2$)

(Publication No. 22,660)

Irving Rowe, Ph.D.
Polytechnic Institute of Brooklyn, 1957

Adviser: Benjamin Post

The structure of organosulfur compounds has been in doubt. The literature has reported widely varying values of the C-S-C valence angle, sulfur-carbon bond lengths and the dihedral angle. Thianthrene was selected as a typical organosulfur compound. A precise determination of its structure at room temperature has been carried out. The C-S-C valence angle has been found to be $100^{\circ}21'$. The dihedral angle in the molecule is established as $128^{\circ}8'$, as compared to the value of 140° previously published (based on dipole moment measurements). The sulfur-carbon bond length is 1.773 Å. The average carbon-carbon bond length in the molecule is 1.379 Å.

Determination of the X and Z coordinates of the atoms in the thianthrene crystal was established by Fourier techniques, including the use of Patterson and electron density functions. The Y-coordinates of the atoms could not be found in this manner, because of severe overlap in the (hkO) and (Okl) projections. To solve the complete structure, the least-squares refinement process was employed. In spite of poor estimates of the Y-coordinates of the atoms originally employed, a successful refinement was obtained by plotting out intermediate sets of coordinates derived in the course of the least-squares refinement. This permitted visualization of the refinement process and enabled a degree of control to be exercised over the operations of the computing program. The discrepancy factor, R, for the resulting three-dimensional structure, using 1823 reflections, is 18.2%. If doubtful reflections are omitted from this factor, the resulting value of R is 15.7%.

Measurement of intensities at low temperatures, as well as at room temperature has been made in an attempt to obtain atomic temperature factors directly. Atomic temperature factors could not be deduced because of changes in molecular position as the temperature is varied. A method is given for the calculation of "reflecting plane temperature factors." The use of these factors to improve the least-squares computing program is described. A new type of difference synthesis $(F_{T1} - F_{T2})_o$ is proposed for the direct comparison of changes in atomic positions and temperature factors. Coefficients of linear thermal expansion in thianthrene have been measured. The coefficients seem to determine an ellipsoid with the major direction of the molecule as its major axis. It is suggested that, if this observation is found to be generally true in other crystals, the thermal expansion ellipsoid can be used as a preliminary method for establishing the orientation of molecules within crystals. This method would be of value in opaque crystals, where the optical birefringence method can not be used. 135 pages. $2.00. Mic 57-3287

AN EXPERIMENTAL STUDY OF THE REACTION $Al^{27}(d,n)Si^{28}$

(Publication No. 21,746)

Allen Gershon Rubin, Ph.D.
Boston University Graduate School, 1957

Major Professor: Professor Fay Ajzenberg-Selove

The neutron spectrum and angular distributions of neutron groups from the reaction $Al^{27}(d,n)Si^{28}$ were obtained by the method of proton recoils in nuclear emulsions. A thin aluminum target was bombarded with 2.16 Mev deuterons from the M.I.T. Rockefeller Van de Graaff generator and neutrons were detected by means of 400 micron

Ilford C-2 emulsions placed at nine angles to the incident beam. The plates were scanned with a Leitz binocular microscope at 1000 magnification. Neutron spectra were obtained at eight angles, 0^0, 10^0, 20^0, 30^0, 45^0, 60^0, 90^0 and 120^0. A total of 12,500 tracks was scanned. Excited states of Si^{28} were located from these measurements at 1.78 ± 0.10, 4.54 ± 0.2, 4.95 ± 0.2, 6.24 ± 0.08, 6.88 ± 0.06, 7.39 ± 0.06, 7.89 ± 0.06, 8.31 ± 0.10, 8.57 ± 0.08, 9.37 ± 0.04, 10.00 ± 0.10 and 10.25 ± 0.06 Mev. The cross-section for formation of the 9.37 state at 0^0 is 10.1 millibarns per steradian, within a factor of two.

A second bombardment for the same reaction was undertaken with 6.00 Mev deuterons from the M.I.T.-O.N.R. Van de Graaff generator, in order to obtain valid stripping angular distributions. 400 micron Ilford C-2 emulsions were used as before, and were placed at nine angles to the incident beam, at 15^0 intervals, from 0^0 to 135^0. Neutron spectra were obtained at six of these angles. The angular distributions obtained were compared with the predictions of the Butler stripping theory in order to obtain the parities, and limits on the spins of the states in Si^{28} which were reached in the reaction. The angular distributions of neutrons groups corresponding to the levels at 1.78, 6.24, 7.90, 8.57 and 9.39 Mev states are adequately described by $\ell = 0$ distributions. If these groups correspond to more than one unresolved level, as in the case of the 8.57 Mev state, then the spin and parity of the level whose cross-section is largest is 2^+ or 3^+. The angular distribution of the unresolved states at 4.5 and 5.0 Mev was obtained, and the principal peak matches a Butler $\ell = 1$ distribution. One of the states at 4.5 and 5.0 Mev thus has odd parity, and spin between 1 and 4. The 6.88 Mev is poorly resolved at 0^0, but has a distribution which is most likely $\ell = 1$. The 7.39 Mev state, which is poorly resolved, has a nearly isotropic angular distribution. The cross-section for formation of the 9.39 Mev state at 0^0 and 6.00 Mev bombarding energy is 30.6 ± 8 millibarns per steradian. The angular distributions obtained from this exposure followed the Butler predictions quite closely, except at 90^0 and 135^0, where points are consistently higher than predicted. The angular distributions obtained at the 2.16 Mev bombarding energy show poor agreement with the predictions of the Butler stripping theory, which is not expected to be valid for this bombarding energy. The angular distributions of the levels at 6.24, 8.28, 8.57 and 9.39 Mev showed the typically forward stripping distribution, but have isotropic backgrounds and a considerable cross-section at backward angles. The angular distributions of the remainder of the levels were isotropic within statistics. A thorough analysis of the low bombarding energy angular distributions has not been carried out, but it is suggested that a comparison with the stripping theory of Tobocman and Kalos would be of value.

$B^{11}(p,n)C^{11}$

A thin target of isotopic boron has been bombarded with 7.03 Mev protons. The neutrons from the $B^{11}(p,n)C^{11}$ reaction, studied by means of nuclear emulsions, indicate an excited state of C^{11} at 2.01 ± 0.06 Mev.

$P^{31}(p,n)S^{31}$

The reaction $P^{31}(p,n)S^{31}$ has been studied at E_p=17.2 Mev. The energy spectrum of the neutrons was determined by means of proton recoil measurements in nuclear emulsions. The mass excess, M - A, of S^{31} was calculated to be -10.04 ± 0.20 Mev. Excited states of S^{31} have been located at 1.15 ± 0.15, 2.28 ± 0.20, 3.35 ± 0.20, 4.51 ± 0.15, 5.94 ± 0.30 and 6.41 ± 0.20 Mev.

141 pages. $2.00. Mic 57-3288

A NEW DETERMINATION OF THE INTENSITIES OF PRIMARY COSMIC RAY ALPHA PARTICLES AND Li, Be, B NUCLEI AT $\lambda = 41.5^0$ USING A CERENKOV DETECTOR

(Publication No. 22,110)

William R. Webber, Ph.D.
State University of Iowa, 1957

Chairman: Professor J. A. Van Allen

Measurements of the intensities of the alpha particles and Li, Be, B nuclei in the primary cosmic radiation have been made at an average atmospheric depth of 18.5 g/cm^2 in two "Skyhook" balloon flights at $\lambda = 41.5^0$. The measuring instrument consisted of a thin (3.0 g/cm^2) Cerenkov detector placed within the solid angle of a Geiger counter telescope. This detector yielded unusually good resolution of the alpha particle and Li, Be, B charge components. This fact and the slow rate of rise of the two balloons made possible a detailed determination of the dependence of alpha particle intensity on atmospheric depth. The quality of the data justified a new approach to the problem of extrapolating the alpha particle intensity to the top of the atmosphere. This extrapolation was carried out by fitting a "diffusion" equation of the type previously applied to nuclei with $Z > 2$ to the data at maximum altitude and the apparent absorption M.F.P. of the alpha particle intensity at the top of the atmosphere is significantly lower than has previously been reported.

At 18.5 g/cm^2 the sum of the intensities of the Li, Be, B components was found to be 3.11 ± 0.31 $(m^2\text{-steradian-sec})^{-1}$ and the intensities $J_{Li}/J_{Be}/J_B$ were found to be as 3/4/2. The (light nuclei/medium nuclei intensity ratio (L/M) at the top of the atmosphere as determined by this experiment was 0.35 ± 0.09 or 0.52 ± 0.10 respectively depending on whether the Noon and Kaplon or Fowler fragmentation probabilities were used.

The unique directional properties and energy dependence of the Cerenkov effect made it possible to satisfactorily separate the fast downward moving particles from the slower downward moving particles and upward moving albedo at all altitudes. Extrapolation of the altitude dependence of the fast downward particle intensity to the top of the atmosphere gives an intensity of fast downward particles (presumably primary protons) considerably lower than previously observed.

The vertical intensities at the top of the atmosphere of the various components of the primary radiation as obtained in this experiment at $\lambda = 41.5^0$ are:

Component	Intensity $(m^2\text{-steradian-sec})^{-1}$
Protons	445 ± 45
Alpha Particles	74 ± 5
Li, Be, B	2.28 ± 0.55 (3.32 ± 0.55)
$Z \geq 6$	9.2 ± 1.2

76 pages. $2.00. Mic 57-3289

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

THE SIMULTANEOUS REFLECTION OF X-RAYS FROM CRYSTALS OF ALPHA-QUARTZ, POTASSIUM SULFATE, AND AMMONIUM SULFATE

(Publication No. 22,662)

Robert S. Williamson, Ph.D.
Polytechnic Institute of Brooklyn, 1957

Advisers: I. Fankuchen and P. P. Ewald

The phenomena associated with the simultaneous reflection of X-rays from single crystals of alpha-quartz, potassium sulfate, and ammonium sulfate have been the subject of detailed investigation. Particular emphasis has been given to the study and elimination of the influence of experimental techniques on measurements of the type previously described by Renninger.* In these measurements the variations in the intensity of a Bragg reflection are recorded as a crystal is rotated about a normal to the reflecting crystallographic planes through an orientation which results in simultaneous reflection from a second set of planes.

Two new techniques have been developed. The first of these makes use of a planar beam reflected from a single crystal as an incident beam for the test crystal and utilizes the vertical divergence of this beam to obtain the equivalent of small rotations for a stationary crystal. The second, more practical method uses a beam of extremely small divergence obtained from a two crystal monochromator-collimator of new design which features successive symmetricall 111 reflections from germanium crystals with perpendicular planes of incidence. The latter method has made it possible to obtain quantitative information concerning simultaneous reflection effects on the "forbidden" 00-1 and 00-2 and weak 12-0 reflections from quartz as well as ammonium sulfate and potassium sulfate OkO reflections covering a wide range of intensities.

These studies show that the characteristics of the resulting increases in the intensity of weak reflections are essentially similar for crystals of low imperfection such as natural quartz and for highly imperfect crystals. Although not generally realized, strong reflections also can be influenced appreciably by simultaneous reflections, particularly in the case of highly imperfect crystals. Only decreases in intensity were observed for such situations (by as much as thirty percent for strong ammonium sulfate reflections, for example), evidently produced by extraction of energy from the incident beam by the second reflection.

Finally, one objective of these experiments was to investigate the possibility of obtaining information which would permit the direct determination of the phases of the reflections involved. Although a theoretical treatment of the process is not presently available, the observed symmetry of the experimental curves for the intensity variations of weak reflections shows some similarity to the electron diffraction phenomena from which Kambe and Miyake# apparently have been able to calculate relative phases.

182 pages. $2.40. Mic 57-3290

*M. Renninger, Zeitsch. für Phys., 106, 141 (1937).
#K. Kambe and S. Miyake, Acta Crys., 7, 218 (1954).
K. Kambe, Acta Crys., 7, 777 (1954).

PHYSICS, ELECTRONICS AND ELECTRICITY

THE MOST PROBABLE ENERGY LOSSES OF 125 KEV-150 KEV ELECTRONS TRAVERSING VARIOUS MATERIALS

(Publication No. 22,183)

Norman Hailstone Roberts, Ph.D.
University of Washington, 1957

Values of most probable energy loss have been determined for electrons in the energy range 125Kev to 150Kev traversing thin foils of mica, aluminum and beryllium. The electrons were accelerated by a Van de Graaf generator, and were allowed to pass through the high potential electrode. They traversed the target material at high potential and were then decelerated as they left the sphere. Electrons scattered through angles of 15^0 or less were collected by a Faraday cage to which a range of positive potentials was applied. The integral distribution curves so obtained were differentiated and the position of the peaks of the resulting differential distribution curves determined.

Values of most probable energy loss obtained for several thicknesses of mica at 140Kev agreed well with values extrapolated from the empirical distribution curves of White and Millington. However, values of most probable energy loss for Al and Be increased much more rapidly with decreasing initial energy than predicted by the theory of Landau. The discrepancy was attributed more to severe scattering in the foil material than to the near-failure of one of the validity conditions of the Landau theory.

104 pages. $2.00. Mic 57-3291

PHYSICS, NUCLEAR

INTERACTION OF 380-KEV POLARIZED NEUTRONS WITH COMPLEX NUCLEI

(Publication No. 22,332)

Joseph Dale Clement, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor H. H. Barschall

The average polarization of 380-kev Li(p,n) neutrons, emitted at a laboratory angle of 50^0 with respect to the proton beam was measured to be $-.38 \pm .03$ by determining the right-left asymmetry in the intensity of neutrons scattered at 90^0 from oxygen. The energy spread of the neutrons was about 86 kev. Oxygen scattering phase shifts used in the calculation were based upon a previous experiment.

Measurements of the polarization $P(\theta)$ produced in scattering neutrons from elements ranging in atomic weight from 64 to 238 were made for 24 elements at a scattering angle $\theta = 55^0$, 23 elements at $\theta = 90^0$, and 19 elements at $\theta = 130^0$. For some elements additional measurements were made at $\theta = 72^0$, 100^0, and 110^0.

With a few exceptions $P(\theta)$ varied smoothly when plotted as a function of atomic weight, exhibiting no pronounced dependence upon the spin of the heavy nucleus.

Some of the prominent features in the experimental results were: for atomic weight $A \approx 100$, $P(55^0)$ and $P(90^0)$

showed peaks of magnitude + .13 and +.15, respectively; at 130^0, for $A \approx 100$, the polarization was about +.02; $P(90^0)$ had negative values of about -.04 and -.07 at $A \approx 75$ and 175, respectively.

The results were compared with polarizations calculated assuming a complex square well model with the addition of a spin-orbit interaction at the nuclear surface.

55 pages. $2.00. Mic 57-3292

ANGULAR DISTRIBUTIONS IN FISSION PRODUCED BY ALPHA PARTICLES AND DEUTERONS

(Publication No. 21,200)

Clifford Tristram Coffin, Ph.D.
University of Washington, 1957

Angular distributions of fission fragments have been measured for fission induced in a series of targets by 20 to 43 Mev alpha particles, 12 to 22 Mev deuterons and 11 Mev protons. The targets used include Bi^{209}, Ra^{226}, Th^{232} U^{235}, U^{238}, Np^{237}, and Pu^{239}. An angular distribution was measured essentially by catching the fragments produced by a cyclotron irradiation of a fission target on catcher foils located at many angles around the target, and then, after the irradiation was over, counting the radioactivity of the fragments caught on the catchers with Geiger counters.

An analysis of the angular distributions leads to the following results:

(1) The anisotropy (the ratio of the fragment intensity along the direction of the incident particle to the intensity at right angles to this direction) varies smoothly with the value of Z^2/A of the fissioning nucleus.

(2) The largest value for the orbital angular momentum between the fragments that is evident in the angular distributions is small compared to the maximum angular momentum brought in by the incident projectile.

(3) The anisotropy increases rapidly with the angular momentum delivered by the projectile for a given excitation energy.

(4) The anisotropy does not appear to depend at all on the value of the target spin.

(5) The anisotropy decreases with the excitation energy of the fissioning nucleus for a given angular momentum.

(6) There is some evidence that fission can often follow a direct interaction in which the incident projectile does not give up all of its energy and angular momentum to the struck nucleus. 118 pages. $2.00. Mic 57-3293

THE ATOMIC MASSES OF THE STABLE ISOTOPES OF THE ELEMENTS FROM PHOSPHORUS THROUGH MANGANESE

(Publication No. 22,450)

Clayton Frederick Giese, Ph.D.
University of Minnesota, 1957

The 16-inch double-focusing mass spectrometer at the University of Minnesota has been used to measure the atomic masses of the stable isotopes of the elements from phosphorus through manganese. The probable error in the mass values is judged to be about 1/10,000,000. The familiar mass doublet technique was used, in which the masses are measured in reference to the appropriate combinations of the secondary standards C^{12}, H^1, S^{32}, and the standard O^{16}. The present work includes a redetermination of the secondary standards. The mass of C^{12} has been measured by the use of a new mass doublet, $C_4H_4O^{++}$ - $H_2O_2^{+}$, which gives directly the mass of C^{12} in terms of the mass of the standard O^{16}. The masses measured include S^{36}, which had been determined previously only by microwave spectroscopy, and Ca^{46}, which had not been measured before.

The instrument and the method of measurement have been described in detail in earlier reports from this laboratory. The method of measurement, very briefly, involves oscilloscopic display of the mass peaks combined with fast switching circuits which allow all spectrometer potentials to be changed by precisely measured amounts on alternate sweeps of the oscilloscope. The measurement of a doublet difference, then, reduces to the visual superposition of the high and low-mass peaks of the mass doublet as they appear, respectively, on alternate sweeps of the oscilloscope. Since the time of the previous measurements, there have been a number of improvements made in the techniques of calibration, testing, and general operation of the spectrometer. These improvements are discussed. Included in the discussion of errors and corrections are considerations of the effects of [1] higher order terms in the differential equation describing the behavior of the mass spectrometer, [2] relativistic corrections, and [3] electric dipole moments of the ions. In the course of the measurements, an improved technique was developed for those cases in which it is necessary to obtain ions from solid samples. This technique is described.

The present mass values are compared with previous mass spectroscopic results from Minnesota and from other laboratories. The agreement is quite good in some places and rather bad in others. The differences exhibit no strikingly systematic nature.

Certain mass ratios computed from the present masses can be compared mass ratios measured by the methods of microwave spectroscopy. The agreement is in general good.

The most interesting comparison is that of the present masses with a recent tabulation of masses calculated from nuclear reaction Q-values. The agreement is quite good, the present masses in general agreeing much better with the Q-value results than previous mass spectroscopic results. The differences which remain appear to be systematic. The general trend is as follows. The two sets of masses agree by definition at S^{32}, because the Minnesota value for the mass of S^{32} was used as a standard in the Q-value mass table, which extends upward in mass from this standard to mass 45. These higher masses as determined from Q-values are in every case lower than the mass spectroscopic masses and the differences increase fairly uniformly with mass. In addition, there are 7 cases in which it is possible to predict a Q-value for a [p,α] reaction, using only mass spectroscopic masses. In every such case, the predicted value is higher than the measured value. The average difference for the 7 cases is 15.2 ± 3.3 kev, which appears to be statistically significant. A number of possible reasons for these various discrepancies have been considered and rejected; the cause is at present not known. 88 pages. $2.00. Mic 57-3294

SOME ASPECTS OF BOVINE KETOSIS

(Publication No. 22,192)

Henry Jonathan Adler, Ph.D.
Cornell University, 1957

Following the introduction and literature review, the thesis consists of four parts. The first series of studies deals with diagnostic techniques: a) the selection of an appropriate vessel from which to obtain blood samples for the determination of blood sugar was made since the glycemic level is a significant diagnostic criterion. In the lactating cow the glycemic level of the mammary vein drops significantly below that of the corresponding artery. Because of this, the blood vessel of choice for obtaining samples for diagnostic purposes is the jugular vein; b) the relation between reactions to the Ross test in milk and urine and the degree of ketonemia were investigated. It was found that negative reactions in the milk do not exclude clinically significant ketonemia and positive reactions in the urine do not prove it; c) a new method for acetone estimation that can be applied directly to blood samples in the field was developed.

The second part of the thesis includes three clinical studies:

1. Compulsive pushing in cattle with encephalopathy is a phenomenon that occurs simultaneously with sucking and licking movements in certain cases of ketosis. These activities are normally present in the new-born ruminant and serve as teat-finding functions. On the basis of a comparative study, it was tentatively concluded that the adult animal deprived of mature adaptive devices, by cerebral disturbances, displays primary patterns of its earlier age.

2. A herd of cows fed grass silage of the butyric acid type was found to have a high frequency of positive reactions to the Ross test in normal animals. Three clinical cases were apparent in the herd. Significant quantities of ketones were identified in this silage. It is suggested that the ketones are produced by butyric-acid-organisms and may be responsible for the high frequency of positive reactions to the Ross test. These ketones also serve as an index of butyric acid production.

3. Twenty-seven clinical cases of ketosis were studied. The primary cause of the disease was readily apparent in animals which produced less than 50 lbs. of milk daily. On the other hand, it was not consistently possible to recognize the primary cause in animals which produced higher quantities of milk. It was concluded that subtle disturbances are sufficient to precipitate a clinical case in high-producing cows, and that a diagnosis of primary ketosis is unacceptable since it is based merely on our inability to recognize the primary precipitating factor.

The third part of the thesis deals with theoretical discussions of the special problems of the ruminant. a) A ketogenic ruminant-reproductive trigger is postulated. The components of this mechanism are: a high loss of oxalacetate precursors in the milk which is balanced against a relatively low absorption of oxalacetate precursors from the digestive tract relative to the absorption of ketogenic fatty acids. This combination of factors presents the liver of the high-producing cow with a ketogenic mixture of metabolites. b) This discussion deals with the special status of the rumen flora, their relation to indigestion, their regulation and comparative aspects of the digestive enzymes.

The fourth part of the thesis concerns two problems related to silage: 1) an evaluation of the method employed for the determination of acetone precursors in silage, 2) a preliminary survey of the ketone content of silage and its relation to the frequency of ketosis.

Each of these studies is summarized separately. Abstracts of the case histories and other clinical data are presented in the appendix. 153 pages. $2.05. Mic 57-3295

THE HORMONAL REGULATION OF GLYCOGEN DEPOSITION AND MOBILIZATION IN THE RAT UTERUS

(Publication No. 22,201)

Jack Lawrence Kostyo, Ph.D.
Cornell University, 1957

A study was made dealing with the effects of certain hormones on the deposition and mobilization of glycogen in the smooth muscles of the rat uterus. The whole uterus drained of fluid was analyzed chemically for glycogen by standard methods, and the uterine glycogen concentration was determined on the basis of total uterine wet weight. Since histochemical studies indicated that nearly all the glycogen in the nonpregnant rat uterus is localized in the myometrium, the alterations in glycogen levels observed in these experiments were assumed to occur in the myometrium.

It was found that neither the pituitary nor the adrenal glands influenced the maintenance of glycogen in the uterus of the spayed rat during starvation. However, adrenalectomy resulted in a significant increase in uterine glycogen which may be associated with the loss of the adrenal medulla. Estradiol injections resulted in glycogen increases in the uteri of fasted spayed, spayed-adrenalectomized and spayed-hypophysectomized rats, but the level reached in the latter was somewhat lower than that attained in the other two groups. Progesterone, pregneneolone, testosterone, cortisone, 17-hydroxycorticosterone, 11-desoxycorticosterone and 11-desoxy-17-hydroxycorticosterone were tested for glycopexic activity in the spayed rat, and only testosterone was found to produce substantial increases in uterine glycogen. Cortisone, 17-hydroxycorticosterone and progesterone all failed to inhibit glycogen deposition induced in uteri of spayed rats with estradiol.

Studies on unilaterally pregnant rats indicated that an increase in the glycogen level of the sterile uterine horn occurred from the 15th through the 21st day of gestation,

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approaching the level found for rats in heat. The glycogen content of the sterile uterine horn of rats at the 8-9th day of gestation or pseudopregnancy (with or without deciduomata) was similar to that of the uterus of diestrus rats. Rats killed immediately after parturition had very high uterine glycogen levels which gave no indication that glycogen utilization had occurred in the sterile horn during parturition. Additional evidence indicated that ovarian estrogen may be responsible for the increase occurring in uterine glycogen during pregnancy and that the placenta rather than the pituitary is probably involved.

Intraperitoneal and intrauterine injections of epinephrine produced glycogen depletion in the uteri of estradiol treated spayed rats while subcutaneous injections were ineffective. Cortisone, progesterone and pregnancy were found to potentiate the glycogenolytic action of epinephrine on the uterus. DL-norepinephrine given in large doses also produced uterine glycogenolysis, and the possible conversion of norepinephrine to epinephrine by the adrenal glands did not appear to be involved.

Uterine glycogen depletion was also obtained with injections of extracts of the posterior pituitary, oxytocin and vasopressin, and the glycogenolytic potency of each preparation appeared to be due to its oxytocic activity. Combined injections of epinephrine and oxytocin exhibited additive effects on uterine glycogen mobilization.

In many of these experiments, concomitant glycogen determinations were made on the urinary bladder (smooth muscle), rectus femoris and abdominal muscles. On the whole, the hormonal regulation of glycogen deposition and mobilization in the bladder was similar to that in the uterus. The changes induced in the glycogen of the rectus femoris muscle with hormone treatment were similar to those previously reported in the literature. In addition, glycogen was found to increase in this muscle during the proestrus phase of the estrus cycle and during pregnancy. Abdominal muscle glycogen decreased during pregnancy, and this decrease was correlated with the distension produced by the developing fetuses. 102 pages. $2.00. Mic 57-3296

A STUDY OF TRANSTUBULAR MOVEMENTS OF UREA IN THE DOUBLY PERFUSED BULLFROG KIDNEY

(Publication No. 22,466)

John King Love, Ph.D.
University of Minnesota, 1957

Single kidneys of male bullfrogs were isolated and perfused via the renal artery and renal portal vein with a modified frog Ringer's fluid. In order to trace movements of urea across the kidney tubule wall, isotopic urea was added to one or both perfusion fluids. In some perfusions two different isotopic ureas, C^{13} urea and C^{14} urea, were used simultaneously, one in renal artery fluid and one in portal fluid.

Either inulin or creatinine or both were added to the perfusion fluids to measure the glomerular filtration rate and the contributions to the renal vein effluent of the two different circulations. The urine and renal vein effluent were collected from the ureter and renal vein. Analyses were made for creatinine, inulin, total urea, and isotopic ureas.

Clearance methods showed that in these experiments, net secretion of urea by the kidney tubule occurred, but much less than in the intact bullfrog. The average value for net secreted urea was 0.8 mg/kg/hr.

When isotopic urea was placed in the portal perfusion fluid alone, it appeared in the urine. Since negligible glomerular filtration of portal fluid was assumed, this result indicated that some degree of transtubular movement of urea occurred. This finding confirmed by an independent method results obtained by clearance methods on the bullfrog kidney.

When isotopic urea was placed in the portal perfusion fluid, the observed isotopic activity of the urine was greater than can be accounted for on the hypothesis that the amount of isotope in the urine is equal to the net secreted isotopic urea alone. From this finding the conclusion was drawn that there are transtubular movements of urea other than net secretion. When isotopic urea was placed in the arterial perfusion fluid, the observed isotopic activity of the urine was less than can be accounted for on the hypothesis that the amount of isotope in the urine is equal to the sum of the isotope filtered at the glomerulus and the net secreted isotope. This finding confirmed the conclusion that there are transtubular movements of urea other than net secretion.

Calculations of the rates of transtubular urea movements other than net secretion indicated that, to a rough approximation, these rates were greater than the rate of transtubular urea movement due to net secretion. The average value for transtubular movements of urea other than net secretion when the total urea concentration in the perfusion fluids was 30 mg % (0.005M) was 1.51 mg/kg/hr.

The influence on the interpretion of the results of various possible types of heterogeneity in the kidney, possible storage, synthesis, and destruction of urea by the kidney, and the effect of net water reabsorption was considered. From the finding that there is a reabsorptive transtubular movement of urea in the face of a net secretory movement, a possible prediction is that, with a fixed rate of net water reabsorption, the urea Tm would decrease as the plasma urea concentration increases.

Two experiments were performed varying the concentration of total urea presented to the kidney. The magnitude of the transtubular urea movements other than net secretion changed in a manner consistent with the view that they are chiefly passive diffusion fluxes. However, since aberrant values were obtained for the net secreted urea in the second experiment, no firm conclusions could be drawn.

The intact bullfrog kidney was shown to secrete urea, the values obtained confirming, by a different method, previously published values for the maximal rate of net urea secretion. 164 pages. $2.15. Mic 57-3297

STUDIES ON ULTRAFILTRABLE CALCIUM

(Publication No. 22,483)

Ananda Shiva Prasad, Ph.D.
University of Minnesota, 1957

McLean and Hastings (2) found that nearly 50% of the total calcium is ionic. Recently Hopkins et al.(1) reported that the ultrafiltrable calcium in normals ranged from 65-75% of the total if the serum pH was controlled by saturating the serum with 5% CO_2 prior to ultrafiltration. A study of the effect of pH and CO_2 on ultrafiltrable calcium was carried out using a technique reported earlier.(3) The ultrafiltrable calcium in normals ranged from 45-57% of the total when the serum was handled anaerobically and final pH was 7.3-7.7. The mean ultrafiltrable calcium was 5.24 mg.% of ultrafiltrate ($\pm$ 0.214 s.d.). The result of experiments carried out at 37° C. were the same as those at room temperature. When 5% CO_2 was bubbled through the serum, an initial lowering of pH and increase in CO_2 content resulted and the ultrafiltrable calcium in normals ranged from 57-76%. Therefore, an artefact is produced by equilibrating separated serum with 5% CO_2 thus accounting for higher values of ultrafiltrable calcium in normals as reported by some authors.

Respiratory alkalosis and acidosis was produced experimentally in dogs. The ultrafiltrable calcium decreased slightly or remained unchanged during hyperventilation and increased during respiratory acidosis. A rebound increase in the level of ultrafiltrable calcium in the recovery phase following hyperventilation and a similar but inverse rebound following respiratory acidosis was observed in every case. Inorganic phosphate decreased during hyperventilation and increased during respiratory acidosis and remained so in the early recovery phase. It is postulated that the changes in the ultrafiltrable calcium may be due to concomitant changes in plasma phosphate concentration. Total proteins and fractionated proteins did not show consistent changes to account for the changes in the ultrafiltrable calcium quantitatively. Total plasma calcium changed little or not at all. The plasma potassium increased during and immediately following hypercapnia. The probable mechanism of ventricular fibrillation and cardiac arrest following hypercapnia in experimental dogs is potassium intoxication in the presence of decreased ultrafiltrable calcium.

Statistical analysis revealed that one mole of albumin binds roughly 1.23 moles of calcium in the groups studied. (Group I - normal, Group II - multiple myeloma, Group III - hypergammaglobulinemia due to causes other than multiple myeloma and Group IV - hypoproteinemia). No correlation was observed between nonultrafiltrable calcium and alpha globulin in all the groups. In Group I and Group III, good positive correlation between beta globulin and nonultrafiltrable calcium was found. In Group IV the correlation was negative, although the points were few in number. No correlation was found between gamma globulin and nonultrafiltrable calcium in Group I. In Group II a significant positive correlation was present. In Group III a significant negative correlation was observed and with increasing amounts of this globulin, a decreasing binding effect of calcium was found. Approximately 50-55% of the nonultrafiltrable calcium appears to be bound with albumin in normals. The remaining nonultrafiltrable calcium is in combination with beta globulin and cephalin.

Elevated values of ultrafiltrable calcium were found in hyperparathyroidism, in some cases of multiple myeloma, metastatic cancer and in acidosis without hyperphosphatemia. Decreased values were found in hypoparathyroidism, in cases with hyperphosphatemia, sprue and in a few other debilitating states. In some cases of muscular dystrophy a lowered percentage of ultrafiltrable calcium was observed. In cases associated with protein abnormalities, acidosis, alkalosis, or hyperphosphatemia a direct determination of the ultrafiltrable calcium should be performed as the total calcium fails to show the changes. A comparison of determined ultrafiltrable calcium with that calculated from McLean-Hastings nomogram or Ziesler's mathematical formula agreed well in normal cases but no agreement was found in abnormal cases.

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3. Prasad, A.S., and Flink, E.B.: J. Appl. Physiol., 10:103, 1957

118 pages. $2.00. Mic 57-3298

CARDIOVASCULAR EFFECTS OF ELECTROLYTE IMBALANCE IN THE GOLDEN HAMSTER

(Publication No. 21,596)

Frederick Nicholas Sudak, Ph.D.
Boston University Graduate School, 1957

Major Professor: Professor George P. Fulton

Since high potassium levels are found in blood concurrently with vasoconstriction, it is important to establish the probable interrelationship. Consequently, cardiovascular effects of potassium and possible mechanisms of action were investigated using the cheek pouch of the golden hamster for direct observation of the microcirculation. The results presented in this dissertation were obtained from two related studies: first, by topical application of solutions containing altered concentrations of ions; and second, by intravenous injection of potassium salts.

The vascular pattern of the cheek pouch was investigated and the relationship of structure to functional activity was established as a basis for analysis of comparative effects of solutions with varied salt concentrations. The structural components are arranged in a pattern typical of subcutaneous tissue. The smooth muscle components of the terminal vascular bed are capable of autonomous vasomotor activity, especially in the areas of the vascular sphincters. Vasomotor sensitivity was investigated by topical application of adrenaline chloride and by electrical stimulation of smooth muscle.

A new physiological solution was formulated containing potassium, calcium and hydrogen ion concentrations similar to the amounts found in the whole blood of the hamster and other mammals as determined by flame photometry and other quantitative methods. This solution was compared with conventional mammalian solutions which

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originated as modifications of Ringer's amphibian solution for use on mammalian tissues. Conventional solutions produced vasoconstriction, capillary and venous stasis, and inconsistant sensitivity to direct electrical stimulation and topically applied adrenaline chloride. The new solution maintained constant physiological activity.

The occurrence of vasomotion was found to be maintained in part by the ionic constituents in the fluid environment of the blood vessels. Vasomotor activity ceased in the absence of potassium ions, when the pH of the medium was above 7.6 or below 7.2, and in the presence of an excess of potassium (doubled). Vasomotion could be induced with physiological concentrations of potassium.

Excessive potassium (two- or three-fold) in the fluid environment of blood vessels produced a significant constriction at one hour. The vessel sensitivity to topically applied adrenaline chloride progressively increased during the same time period. The constrictor effect of potassium was augmented by the addition of calcium in proportion to the increase in potassium ions.

Since the vasoconstrictor effect of calcium was blocked with 'dibensyline', isotonic solutions of calcium chloride were used as a functional test for the presence of an active nerve supply to blood vessels. Furthermore, a functional test for the presence of smooth muscle was established with isotonic solutions of potassium salts.

Potassium concentrations comparable with those found in vivo during toxic states (60 mg percent) were not able to stimulate blood vessels directly when applied to preparations blocked with 'dibenzyline'. A minimum of 280 mg percent of potassium was necessary to stimulate smooth muscle cells directly in the absence of functional nerves. Under these conditions, calcium was able to antagonize potassium.

During severe hyperpotassemia induced by intravenous injection of potassium chloride (1 percent), serum electrolyte levels were correlated with changes in the electrocardiograms and vasomotor responses. The electrocardiographic responses to hyperpotassemia were similar to those reported in man and other species. Although significant vasoconstriction occurred during hyperpotassemia, the action of potassium was not a direct peripheral effect on the blood vessels. Vascular responses were diminished by adrenalectomy and abolished by adrenergic blockade. The level of potassium in toxic conditions was found to be 52 to 60 mg percent (13 - 15 mEq/1). This concentration is only one fourth the amount required to stimulate vessel walls directly. Other possible mechanisms responsible for the constrictor effect of potassium were discussed.

109 pages. $2.00. Mic 57-3299

I. THE EFFECT OF EPINEPHRINE ON ARTERIAL-CORONARY SINUS POTASSIUM DIFFERENCE AND CARDIAC RHYTHM IN DIGITALIZED DOGS. II. THE EFFECTS OF AUTONOMIC NERVE STIMULATION AND ATRIAL STIMULATION ON HEART RATE AND MYOCARDIAL POTASSIUM EXCHANGE IN DOGS ANESTHETIZED WITH SODIUM PENTOBARBITAL.

(Publication No. 22,427)

Robert Gerald Sybers, Ph.D.
The University of Wisconsin, 1957

Supervisor: Associate Professor Quillian R. Murphy, Jr.

I

The effect of epinephrine on the myocardial potassium exchange in digitalized dogs was studied in the following manner. Continuous arterial and coronary sinus blood samples were withdrawn simultaneously during and after the injection of epinephrine in 10 digitalized dogs. The samples were analysed for potassium content and the results compared with those obtained from 5 control dogs anesthetized with sodium pentobarbital. The following observations were made.

1. In the digitalized dogs following the injection of epinephrine, the average arterial potassium rise and the maximum arterial potassium concentration reached were less than those observed in the controls.

2. In the digitalized dogs following the injection of epinephrine, at the time when the arterial potassium concentration was rising, there was a negative arterial-coronary sinus potassium difference in 4 dogs, no significant difference in 5 dogs, and a positive difference in 1 dog.

In contrast to this, all five control dogs, following epinephrine, showed a positive arterial-coronary sinus potassium difference during the rise in arterial potassium concentration. None of these dogs had a significant negative difference during this time.

3. Cardiac sensitivity in response to epinephrine was greater in the digitalized dogs than in the controls as evidenced by the appearance of ventricular tachycardia. It was further noted that the onset of ventricular tachycardia was associated in time with the altered myocardial potassium exchange observed in the digitalized dogs.

II

The effects of atrial stimulation and autonomic nerve stimulation on the arterial plasma potassium concentration, arterial-coronary sinus potassium difference, and heart rate were studied in 33 dogs anesthetized with sodium pentobarbital. The following observations were noted.

1. Throughout the course of these experiments there was no appreciable change in the arterial plasma potassium concentration.

2. The arterial-coronary sinus potassium difference was negative in the 10-30 second period after the beginning of stimulation in all of the animals whether the stimulation was applied to the cardiac sympathetic nerves, the atrium, or both. Following this negative potassium difference in the arterial-coronary sinus potassium difference became

positive while the stimulation was continued and remained positive throughout the remainder of the test period (90 seconds after the termination of stimulation).

3. The heart rate was markedly increased during stimulation of the right cardiac sympathetic nerve, the right atrial appendage, and combined stimulation of the atrial appendage and cardiac sympathetic nerve for a period of 60 seconds. Immediately following the termination of stimulation of the atrium, the heart rate returned to the control level, whereas, with cardiac sympathetic stimulation or combined atrial and sympathetic stimulation, the heart rate gradually returned to near the control level between 1 and 2 minutes after the stimulation was stopped.

4. Stimulation of the right cardiac sympathetic nerve or both cardiac sympathetic nerves for 150 seconds did not alter the magnitude or course of the arterial-coronary sinus potassium differences from those seen with only 60 seconds of stimulation. However, the heart rate was maintained at an elevated level throughout the 150 second period of stimulation.

5. Vagal stimulation produced a marked decrease in heart rate. The arterial-coronary sinus potassium difference was always positive throughout the period of effective stimulation. Atropine abolished the effects of vagal stimulation on both heart rate and arterial-coronary sinus potassium difference. 38 pages. $2.00. Mic 57-3300

POLITICAL SCIENCE

POLITICAL SCIENCE, GENERAL

THE LEGISLATIVE PROCESS: A CASE STUDY OF THE PASSAGE OF THE MINNESOTA YOUTH CONSERVATION ACT WITH EMPHASIS ON THE ROLE OF THE INDIVIDUAL

(Publication No. 22,449)

Floyd Orville Flom, Ph.D.
University of Minnesota, 1957

Adviser: Professor Lloyd M. Short

This case study deals with an act passed by the Minnesota Legislature in 1947. Beginning with the genesis of the Model Youth Correction Authority Act by the American Law Institute, the dissertation describes the activities carried on by leaders of the Institute and members of other national and Minnesota organizations to organize and promote public support for the measure, the development of public opinion concerning the issue as a result of these activities, the process by which the measure became a political issue upon which politicians took sides, and the legislative process by which the measure was enacted into law.

The principal sources of data utilized for the dissertation were the files of individuals involved in the movement on the side of the proponents and the opponents of the measure, supplemented by extensive interviews with these and other individuals, including legislators and administrators of state government. Legislative journals, newspapers, proceedings and publications of interest groups, and articles and books provided other sources of data. A final source was the author who served in the legislature during the session when the measure was enacted into law.

The author's introduction to the dissertation reviews research in the legislative and group processes and critically evaluates the hypotheses set forth in that research, the primary criticism being directed at the tendency of the writers in this field to look to the group rather than the individual for their explanations and conclusions concerning the legislative and political processes and the behavior of individuals involved in those processes.

Proceeding on the assumption that the group interpretation of politics is inadequate, and that the key to an understanding of political behavior and the legislative process is to be found in the individuals who act out the process, the dissertation presents the data in such a way as to place the individual at the center of attention, with groups placed in a secondary role and viewed as instruments or social mechanisms through which the individual acts to achieve his values.

Conclusions concerning the hypotheses set forth in the study are as follows:

1. The political behavior of an individual is motivated by his desire to project his values concerning social problems into public policy.

2. The causal factor which energizes the political process stems from the activity of policy-motivated individuals which is carried on for the purpose of influencing others toward the same end.

3. The means used by policy-motivated individuals to exercise power or influence over the behavior of others is through the communication of knowledge about the problem and the proposed solution, the result being a revision of the beliefs and values of the decision-makers, their opinions and behavior being thereby modified.

4. Individual values are projected into group values through the communication of knowledge about the problem and solution to members of the group through the intra-group policy and communication channels, with group values forming as a result of the impact of the knowledge on the beliefs and values of the members of the group.

5. The communication of knowledge and the formation of public opinion about political issues is carried on to a large extent through the channels of the political interest groups which are affected by the issue.

6. Public opinion in a general sense results from the communication of knowledge about an issue by proponents and opponents as they debate the issue through the communication channels which reach the general public.

7. The legislators' decisions concerning what public policy should be are based on their own beliefs and values

concerning the issue as shaped by the knowledge they have acquired regarding it. 602 pages. $7.65. Mic 57-3301

MR. JUSTICE FRANKFURTER AND CIVIL LIBERTIES AS MANIFESTED IN, AND SUGGESTED BY, THE COMPULSORY FLAG SALUTE CONTROVERSY: A STUDY OF FIFTEEN YEARS OF SUPREME COURT OPINIONS, 1939-1953

(Publication No. 22,451)

Royal Clarence Gilkey, Ph.D.
University of Minnesota, 1957

Adviser: William Anderson

The problem undertaken is a critical and interpretive analysis of Justice Frankfurter's judicial performance from 1939-1953 in controversies involving constitutional freedoms. Its starting point and continuing frame of reference is the judicial philosophy that determined his position in 1940 as majority spokesman in the first flag-salute case (Gobitis) and as separate dissenter elaborating the basis of his original stand upon its reversal three years later (in Barnette). Thus, while professing personal sympathy with libertarian causes (exemplified by efforts to defend aliens suspected of radicalism and to ensure justice in the Mooney, Sacco-Vanzetti, and the Bisbee deportation controversies, etc.), he parted company with a repentant judiciary which, in an unprecedented turnabout, decided to follow the lead of Justice Stone's classic dissent from the initial 8-to-1 ruling against Jehovah's Witnesses who had challenged the flag-salute requirement in public schools as an infringement of religious liberty.

Frankfurter's flag-salute opinions presented ideas repeatedly emphasized in other judicial pronouncements wherein, according to his understanding of Holmesian doctrine and the Court's limited function, he stood for depersonalized judging and the rational standard; urged respect for legislative judgment; disputed the notion of a "preferred position" for freedom guarantees over constitutional rights like those of property; condemned the distortion of Holmes's literary "clear-and-present-danger" phrase into a test for constitutionality as conducive to mechanical jurisprudence; recognized the principle of a fair balance of interests (evident in picketing and free speech cases); discountenanced the claims of conscience to immunity from nondiscriminatory civil regulation; opposed the absolute interpretation of constitutional rights (save in the instance of the establishment clause requiring full enforcement to ensure complete separation of church and state); and championed the vindication of minority rights in the community rather than the courtroom to keep democracy vitalized. Frankfurter's restraintist approach in the judicial review of minority rights generally turned him aside from the merits of the claims in important civil liberty controversies like those over the obligation to bear arms, the loyalty-oath (except where it threatened academic freedom), wartime restrictions on West Coast Japanese-Americans, and Bible-reading in public schools. Reluctant to face constitutional questions, he sometimes showed ambivalence (as in Dennis).

The foregoing factors, while by no means exhausting the possibilities, help to explain the Justice's voting record on the Court and especially the unlibertarian results to be found in some measure therein. Critics tend to charge these unlibertarian results against him without taking into account the matrix of his thought which grew to maturity in a time when the judiciary tended to overreach its province and produce a sense of frustration especially as to socio-economic adjustments in the democratic community. Frankfurter absorbed Holmes's disgust at these judicial excesses and adopted the then liberal remedy of self-restraint among judges, upon which he has continued to insist in the face of contentions by activist-minded justices (like Black and Douglas) that the Court should intervene actively to safeguard civil liberties.

The belief that this should remain the responsibility of the community lest the victories of liberalism prove illusory and short-lived can hardly be called the mark of an illiberal or conservative mind. Granting the Justice's personally genuine devotion to the First Amendment freedoms, his position on community rather than court vindication of civil liberties must still be considered too one-sided. Both the Supreme Court (as America's conscience refined) and the people (as democracy's ultimate foundation) are needed to remain vigilant, with either to counteract any faltering by the other, in the assurance of maximum protection to minority rights consonant with good order. 707 pages. $8.95. Mic 57-3302

THE QUEST FOR CONSTITUTIONAL EQUALITY AMONG THE STATES IN THE UNITED STATES

(Publication No. 22,454)

Luther Guy Hagard, Jr., Ph.D.
University of Minnesota, 1957

The states in the United States are generally regarded as "equal in all respects whatever," a view which has been sanctioned numerous times by the Supreme Court of the United States. The presently accepted doctrine is that the states are "equal in power, dignity, and authority, each competent to exert that residuum of sovereignty not delegated to the United States by the Constitution itself." In the history of our country there have been many attempts to determine the meaning of this equality.

During the colonial period of our history, various plans of union were advocated for the colonies. Problems arose concerning the status of the member colonies in the proposed unions, but the principal matter confronting the colonies was to achieve union, regardless of its basis. The precedent of equal representation of the colonies was established during this period, without regard to population or financial status of the colonies. Although equally represented, the colonies furnished men and supplies for the common defense proportionate to population or ability.

Equality of representation was continued during the Continental Congresses, and was given formal sanction in the Articles of Confederation. The larger colonies protested that the equality of votes by colonies had been but an expedient to further the organization of union. The smaller colonies answered that it was only fair that the colonies as such should be represented. Little concern was voiced regarding the powers which would be exercised

by the individual colonies, the assumption being that they would be left free by the central government to handle their own affairs. "Internal police" and "equality of states" were confused during our early constitutional history.

In the Constitutional Convention the problem of representation was solved through compromise, each state to be entitled to equal representation in one house of the Congress, with proportional representation in the other. Recognition of the voting equality of states was given through various other constitutional provisions. Since the settlement of the question of equal voting by the states, the search for state equality has gone on in other areas.

After the admission of Vermont, thirty-four states have been admitted to the Union. In each instance, Congress has indicated that the states were admitted on an equal footing with the original states. The matter of equality has been complicated by various conditions or restrictions which the Congress has required of the new states. In some of the states, public lands sold within the state were not to be taxed for a specific number of years. In other instances, restrictions forbade the moving of the state capital from one city for a number of years, forbade polygamy within a state, and prohibited a state from including recall of judges in the state constitution. Congress permitted one state to retain the public lands within its boundaries, yet provided that the state would be on an equal footing with the other states.

The Supreme Court of the United States has settled considerable litigation concerning restrictions imposed on states, trying to arrive at some meaning of equality. The Court has invalidated restrictions which make the states unequal in power, or which place them under Congressional domination. However, the Court has upheld restrictions concerning property use or taxation. These are regarded as proper matters for agreement between the national and prospective state governments.

The quest for constitutional equality has not ended, and the search goes on to find means of determining equality of states. 543 pages. $6.90. Mic 57-3303

PROBLEMS IN THE LAW OF MISTAKE IN CONTRACTS. A STUDY IN ANGLO-AMERICAN LAW WITH REFERENCE TO JEWISH LAW.

(Publication No. 22,062)

Jonathan Plato, J.S.D.
Columbia University, 1957

The purpose of our thesis is to suggest an analytical understanding of the law of mistake in contracts, with the "objective" or the "expectation" theory as the basic norm of our exposition. The analysis is based on the study of the Anglo-American law of mistake, and we try to show that an "objective" conception regarding the binding force of contracts may also be derived from a study of the ancient Jewish Rabbinical law in this matter.

The ethical basis of contract may be either subjective or objective. The "subjective" or "meeting of the minds" theory would require an implementation of the wills of the parties in a valid contract, and therefore mistake of any kind, on the part of one or both parties, would prevent the apparent agreement from being binding. On the other hand, the "objective" or "expectation" theory would consider the promisor bound by his promise if the promisee, relying on the conduct and outward expression of the promisor, has a reasonable and justified expectation that the promise would be fulfilled. Thus, the determination as to whether a mistake is a good excuse for rescinding or reforming the contract would partly depend on the opinion of the court as to which expectation should be protected by law, rather than determining if a real meeting of the minds has taken place.

The fundamental approach of the Anglo-American law to the problem indicates, in the case law as well as in the American Restatement of the Law, an application of the idea that a binding agreement consists more in the manifestation of consent than in mental consent. Mistake, which is partly defined as a state of mind that is not in accord with the facts, may not thus be sufficient to prevent the binding force of the contract.

The Jewish law, on the other hand, does not at all attribute too much importance to "consent" as such, and requires formal outward expressions for making promises valid. Its famous maxim is that "mental stipulation" is not generally recognized to contradict what was said and understood by the other party. This leads us to the impress that the protection of justified expectation also has much value in that ancient law.

As far as formation of the contract is concerned, the mistake consists in the party's wrong suppositions about a certain fact. The solution is based on comparing the fair expectations of the parties. If the existence of a contract is in dispute, and the court finds that there was no justification to expect a valid of agreement, the rights of the parties are settled on a non-contractual basis. If the mistake concerns the identity of the parties, the court evaluates the agreement according to the expectation of each party as to the relevance of the identity of the other party. In cases of mistake regarding the attributes, value or usefulness of the subject-matter, we find that courts are inclined to judge according to the extent each party expected the other to assume the risk of discrepencies in such attributes. The Jewish law adopts a very similar view in evaluating what amounts to an "error" in the transaction which entitles the mistaken party to rescission.

In mistake in performance, the equitable relief of restitution is also based on giving effect to the expectations of the parties concerning the nature and extent of the performance. The intervention of equity in cases of unilateral mistakes is completely reconcilable with our theory if the mistake was known to the other party; no expectation has to be protected and the granting of relief is justified. However, if the unilateral mistake is honestly unknown to the other party, the policy of the courts to sympathize with the mistaken party sometimes conflicts with their policy to protect the justified expectations of the other party. This slight departure from the expectation theory does not, however, impair its application as a general judicial policy. 147 pages. $2.00. Mic 57-3304

THE WISCONSIN COUNTY BOARDS OF SUPERVISORS: A STUDY OF THEIR ORGANIZATIONAL AND OPERATIONAL CHARACTERISTICS

(Publication No. 22,482)

Lloyd Wilber Woodruff, Ph.D.
University of Minnesota, 1957

This is a description and analysis of 70 of the 71 county governing boards in the State of Wisconsin. The 71st board was excluded since it is an exception to the basic organizational pattern found in the other counties. These 70 boards are based on the township-supervisor form of county governing boards. Their characteristics are highlighted by their exceptionally large memberships. In 1947 their average membership was 35 which was five times larger than the national average of seven members per board. The study includes one of the largest boards in the nation: this board had 82 members at the time of this study.

A review of available studies showed that relatively little was known about actual conditions. Many observations had been made but for the most part these were based on limited examinations. Broadly stated, the basic purpose of this study was to enrich and expand existing knowledge. Throughout the study emphasis was placed on developing data about the characteristics of the several boards. The major source of data was the official proceedings and directories published by the governing boards and county clerks. Many of the examinations were based on board operations that had occurred over a period of one year.

The major findings of the study were: (1) that board organizational and operational characteristics varied greatly throughout the state; (2) that board size was not a major determinant of variations in board characteristics but that local, community factors such as population and urbanism appeared to be major determinants; (3) that divisions of votes on controversial issues were not necessarily divided along urban-rural lines of board membership; and (4) that the Wisconsin County Boards Association has become an important adjunct to state-county administrative as well as state-county legislative relationships.

The hard core of the study is found in a series of 42 tables and figures. These report such information as: the total membership and the distribution of members among the large cities, small cities, villages, and towns, by county; the number and size of board committees, by county; the number and frequency of board meetings, by county; the number and types of votes cast, by county; the types of business about highway affairs, by county; and the division of opinion on selected roll calls, by unit of local government in 17 counties.

Many of the analyses were based on correlation diagrams and coefficients of correlation. These included the relationship of: county population to board membership; board membership to the proportion of three-member committees; and board meetings to county population. Among other analyses were shown the proportion of viva voce votes to total votes; the proportion of committee positions assigned to town supervisors in selected counties; and the relationship of city to town voting patterns.

255 pages. $3.30. Mic 57-3305

POLITICAL SCIENCE, INTERNATIONAL LAW AND RELATIONS

MOROCCO: FROM PROTECTORATE TO INDEPENDENCE, 1912-1956

(Publication No. 21,963)

Rashid Kabbani, Ph.D.
The American University, 1957

The purpose of this dissertation is twofold: 1) to analyze the origins and subsequent development of the international problem of Morocco and 2) to study the status of Morocco in contemporary world affairs.

Chapter I gives a brief survey of historical origins in an attempt to bring to focus the factors shaping the Moroccan dilemma. Chapter II inquires into the course of Great Power rivalry which resulted in the establishment of the French Protectorate. Chapter III examines the Protectorate arrangements from legal and political viewpoints. In Chapter IV attention is given to the origins and development of nationalism in Morocco and to the role of the various political parties in Franco-Moroccan negotiations. Chapter V is devoted to a study of the Moroccan question in the United Nations. Chapter VI treats the Moroccan crisis of 1953 and the developments leading to the Franco-Moroccan treaty of interdependence. The dissertation concludes with a critical analysis of the Moroccan problem as a whole as it has developed since the latter part of the nineteenth century.

In undertaking this study the candidate relied on United Nations documents, official records of the French and Moroccan governments, and relevant secondary materials in the English, French and Arabic languages. The method of conducting research and the presentation of the results of the research are both analytic and historical.

The struggle in Morocco revolves around Franco-Moroccan cooperation and conflict, and the central issue is whether co-administration is in fact reconciliable with internal autonomy and independent native government. French policy at present appears to be based on the assumption that co-administration is, or will prove to be, compatible with Moroccan autonomy. Accordingly the French government hopes that Moroccan nationalists will accept interdependence with France and consequently a regime governed partially by Frenchmen.

The state of agitation which prevailed in Morocco between 1944 and 1956 had its roots in certain social conditions, which seem to be decisive, and also simply in the turns of political events. One such social condition was the rise of an urban proletariet, a consequence for the most part of the disintegration of the tribes. Another underlying factor was the inadequate adaptation of young people to the new forms of city life and civil administration which the French have been trying to establish. Furthermore, chronic shifts of policy from the departure of Lyautey until 1956 unsettled the equilibrium which he had established.

The Franco-Moroccan treaty of interdependence marked the beginning of a new era for Morocco. The contemporary problems of Morocco are complex, but it may be said that the prospects for this new era will depend on considerable part upon the ability of Moroccan and French leaders to resolve the major economic and constitutional difficulties. 188 pages. $2.45. Mic 57-3306

DEVELOPMENT OF RELATIONS BETWEEN INDIA AND THE UNITED STATES, 1941-1952

(Publication No. 21,964)

Shiwaram Krishnarao Kshirsagar, Ph.D.
The American University, 1957

The purpose of this study is to define and to investigate the major problems in the development of political, economic and cultural relations between India and the United States, 1941-1952, in an effort to reach an understanding of the rationale behind their policies. It is essential to begin the discussion in 1927 at which time the Indian National Congress party defined its objective of complete independence from Great Britain. During the Indian struggle for freedom, 1927-1947, the Indian National Congress demanded independence from Great Britain many times, but Britain ignored all demands. As a result, in the middle of World War II, a political deadlock developed between the British bureaucracy and the Indian National Congress.

In 1942 the British-Indian controversy aroused concern in the United States, since the controversy directly affected the Allied war effort against Japan. Colonel Louis Johnson, the personal representative of President Franklin D. Roosevelt participated in the efforts made by the Cripps Mission to resolve the deadlock, but in spite of his assistance the Mission was a failure. During the same period, at the request of the Indian Government, the United States sent the Grady Mission to India to assist her in increasing India's production of war materials. The recommendations of the Mission produced beneficial results. The continued interest of the United States prompted the President to send Ambassador William Phillips to India to resolve the deadlock but the political differences continued even after his return to the United States.

In 1945, after the Allied victory in Europe, the British government made two unsuccessful attempts to solve the Indian problem. She conducted the Simla Conference in June-July 1945, and she sent a Cabinet Mission to India in the Spring of 1946. Then, in 1947, as a result of the Indian struggle for independence and the Muslim League's demand for the establishment of Pakistan, India and Pakistan achieved their independence.

The analysis of Indian foreign policy contained in this study shows that that policy has been based on such factors as the geopolitical situation in Asia; the principle of self-determination; the principle of non-alignment with either the Western or the Communist bloc; and anti-imperialism, Communist or otherwise. On the other hand, United States foreign policy in South Asia has been based on such principles as anti-Communism, establishment of a collective security system in that area, and foreign aid in the form of economic and technical assistance.

In the application of their respective foreign policies to major issues India and the United States have followed different courses. However, both India and the United States have shown that they are determined to stop Communist imperialism. The issues toward the resolution of which India and the United States have taken contrasting approaches include, among others, the Korean conflict, recognition of Communist China and the Japanese Peace Treaty.

A fundamental point made in this study is that the United States has shown increasing interest in India's efforts to build a sound national economy. In 1951 the United States wheat loan, under "The India Emergency Food Aid Act of 1951", helped save India's millions from famine. Also, the United States has given India economic and technical assistance and has helped India to complete her first Five Year Plan and to continue the second.

This study shows that India's acceptance of United States foreign aid has not affected Indian freedom of action.

At the same time, it shows that the Indian-United States educational exchange program has made a notable contribution to mutual understanding.

After analysing the major problems which arose in the relations between India and the United States between 1941 and 1952, the writer is convinced that both nations sincerely support the efforts of dependent peoples to achieve their independence.

The primary sources include official documents pertaining to the study. The secondary sources of the inquiry are selected books, periodical literature and newspapers published in Great Britain, India and the United States. Analytical, historical and comparative methods were used in preparation of this study.

Upon the basis of this research and study an analysis of Indian and United States foreign policies has been made from which it may be anticipated that in future international policy decisions both nations will continue to champion the cause of democracy.

293 pages. $3.80. Mic 57-3307

SOVIET CONTROL OF INTERNATIONAL COMMUNISM

(Publication No. 22,096)

Edward Branson Richards, Ph.D.
State University of Iowa, 1957

Chairman: Professor Vernon Van Dyke

The question of Soviet control of an international communist movement became particularly relevant to students of communist activities with the establishment of the Third (Communist) International in 1919. This organization was ostensibly created for the purpose of discussing, coordinating, and implementing the policies and activities of its member parties. The Third International was, also ostensibly, a federally organized body whose members retained local autonomy in their domestic affairs. Much material published over the last thirty years or so has demonstrated that this international communist organization was actually controlled by the Communist Party of the Soviet Union, which Party also controlled the Government of the Soviet Union.

This study has three objectives: (1) to discuss the origins and bases of Soviet control of international communism, (2) to define and analyze the methods that have been used in securing and exercising such control, and (3) to evaluate the effects of Soviet control of non-Russian communist parties. While the study itself may be roughly divided into three parts to correspond to the three objectives, the emphasis of the work is placed upon the definition and analysis of the methods used to control the international organization.

The early chapters are devoted to a discussion of the implications for Soviet control that are inherent in Lenin's

writings and activity from the early twentieth century through the establishment of the Third International. The majority of the study is devoted to an analysis of specific control techniques utilized by the Soviet leadership. The last chapter contains an evaluation of the effects of Soviet control on the international communist movement.

The actual methods by which the Soviet leadership exercised control of the Comintern are found in (1) the authority vested in the Executive Committee of the organization by the Statutes and Constitution adopted in 1920 and (2) the availability of the facilities and resources of the Soviet Government for the promotion and support of the Comintern.

The Statutes and Constitution gave the ECCI control over the conditions of admission to and expulsion from membership in both the Comintern and its Sections. The ECCI had the authority to issue directives and criticisms concerning the policies and activities of the Comintern and its Sections. In addition, the ECCI could send supervisory personnel to see that Comintern Sections complied with the directives; this supervisory personnel was responsible solely to the ECCI. The ECCI was further authorized to establish and direct publications within the Comintern for the purpose of making the decisions and official documents of the ECCI available to the membership. Schools, subject to the direction of the ECCI, were established for the training and conditioning of Comintern members and those non-Communists most sympathetic to the Marxist "cause." These all-inclusive controls over the activity of the Comintern were exercised by the CPSU through its controlling position on the ECCI.

These constitutionally defined controls were supplemented by the use of financial resources, physical facilities, and personnel of the Soviet Government. The CPSU's position as the only member of the Comintern that actually control the government of a State gave the Soviet Party tremendous political and economic advantages over the rest of the members of the CI. The simple fact of the existence of the Soviet Union lent the authority of success to the CPSU's claim to the leading role in the Comintern. The material resources of the Soviet Union, when manipulated to subsidize and support the Comintern, strengthened the CPSU's position as the world's leading communist Party. 216 pages. $2.80. Mic 57-3308

POLITICAL SCIENCE, PUBLIC ADMINISTRATION

VILLAGE GOVERNMENTS IN INDIA

(Publication No. 22,218)

Sridhar Tripathy, Ph.D.
Cornell University, 1957

In India with 83 per cent of the total population living in rural settlements called villages, village self-government is being rapidly extended.

Progress has been made especially since independence in 1947. Almost all states have enacted legislation to give them statutory powers in response to the directive principle of the Constitution. Yet all the villages have not been covered even after a decade of the existence of free India.

The Central and the state governments owe their existence and powers to a single Constitution of India, whereas the village governments like other local governments derive their existence and power from the state. In the process of enacting legislation establishing these village governments, the states have not only given them limited judiciary and executive powers including powers to tax but also appear to have made them structurally, functionally and financially to a limited extent a division of state administration. The state governments administer the local matters through a collector who is the state-appointed chief executive of a district into which each state is divided. Village governments in most states have been placed under the supervision and control of the collector and his staff. This arrangement in a way has reduced the self-government character of these institutions.

Though the state governments and local municipalities and District Boards have uniform organizations in all the states, the village governments have not been given the same uniform organizational character by all the state governments. Broadly speaking, two types of organizations are found. In one type, the entire village adult population constitute a village assembly which elects an executive and approves the latter's programs of work and budget through annual, biennial or special meetings. The other type of village governments found in most states function through representative executive bodies only.

The village governments have been given judicial powers to try petty criminal and civil cases to help reduce the number of cases coming to the regular courts. Though establishment of a separate judiciary has been the most common feature of judicial administration, villages in few states have the judicial powers vested with the executive. Two most common characteristics of the village judicial system are the elected judges and the prohibition of the appearance of legal practitioners before the village courts.

The village people though enthusiastic about organizing their own local governments, are reluctant to tax themselves. Where the statutory regulations provide for compulsory taxes, they have been collected. Lacking this provision villages have mostly depended on grants-in-aid. The general reluctance of the village people to tax themselves stems from the system of state taxation that affects them. Property tax on agricultural lands being levied and appropriated by the state governments, makes imposition of other taxes by the village governments heavy on the rural people. Transferring the land tax to the village governments would lead to establishment of greater number of such governments and increase in their functions.

The village governments need reorganization in all their phases. It is difficult to say which way such reorganization should be made but a plan has been given in the body of the thesis which is intended to provide substantially greater local self-governing powers to villages. 233 pages. $3.05. Mic 57-3309

PSYCHOLOGY, GENERAL

THE EFFECT OF VARYING ILLUMINATION AND DISTANCE ON PERFORMANCE OF SUBJECTS WITH ARTIFICIALLY REDUCED VISION

(Publication No. 22,239)

William B. Chew, Ph.D.
Purdue University 1954

Major Professor: Joseph Tiffin

The two purposes of this study were:

(1) To determine the effect of varying illumination on the relationship between artificially reduced vision and performance on a job-sample test.

(2) To determine the effect of varying distance from the work on the relationship between artificially reduced vision and performance on a job-sample test.

A job-sample test was developed from a naval computer. The test consisted of each subject reporting a setting on a dial as rapidly and as accurately as possible when the dial was exposed to the subject by means of a shutter. Five levels of illumination on the dial and three distances from the dial were used. Two criteria, time and accuracy of response, were used to measure performance.

Ten subjects were used; each subject performed at five artificially reduced levels of visual acuity. The levels of vision were obtained by using crossed-cylinder oblique lenses in front of the subject's eyes. All subjects performed at all levels of illumination and distances.

The data obtained on the two criteria were analyzed using analyses of variance and factorial designs. The results indicated that performance was significantly related to illumination, distance, and vision. Also, the performance of various levels of vision was not affected the same amount when either illumination was reduced or distance increased.

Curves were developed to describe the relationship between job performance and near visual acuity at the three distances and five levels of illumination. The curves showed that performance at poorer levels of vision was reduced more than performance at better levels of vision when either distance was increased or illumination was reduced. 159 pages. $2.10. Mic 57-3310

THE RELATIONSHIP OF POSITIVE RESPONSE BIAS OR ACQUIESCENCE TO PSYCHOPATHOLOGY

(Publication No. 21,908)

David Dana Clancy, Ph.D.
Syracuse University, 1957

Hypotheses:

I Acquiescent responders will be judged "maladjusted" with significantly greater frequency than subjects demonstrating no response set.

II Acquiescent responders will be judged "psychotic-tending" with significantly greater frequency than subjects demonstrating no response set.

III Acquiescent responders will be judged as employing the "psychodynamics of the passive ego" with significantly greater frequency than subjects demonstrating no response set.

IV Psychotic subjects will demonstrate acquiescence to a significantly greater degree than normal subjects.

V Catatonic schizophrenics will demonstrate acquiescence significantly more than normals and paranoid schizophrenics will demonstrate it significantly less then normals.

(Acquiescent response is operationally defined in terms of an original test designed to study this set. Personality judgments with normals are based upon performance on psychological personality tests. Thus personality variables are operationally defined.)

Instruments of Study. -- An original test called the Speed of Decision Test, designed to facilitate its operation, was used to establish relative degree of acquiescence.

The Rorschach, MMPI and D-A-P were the personality assessment instruments used to evaluate the personality variables in testing the first three hypotheses.

Subjects of the Study. -- The first three hypotheses were investigated by comparing fifty acquiescent and fifty neutral scoring subjects derived from a population of five hundred normals by their performance on the Speed of Decision Test. Subjects were all male veterans, applicants for counseling and voluntary research subjects.

The population of five hundred normals served as control group in investigating the last two hypotheses of the study. The psychotic experimental group consisted of twenty-five paranoid and twenty-five catatonic schizophrenics. This total pathological population was used in testing hypothesis IV, while this group was broken into its diagnostic components to examine hypothesis V.

Procedure. -- Five hundred normals were given the Speed of Decision Test, which test was designed to foster the operation of acquiescence. Fifty high scorers and fifty neutral scorers were additionally administered the Rorschach, D-A-P and MMPI. Evaluations based on these instruments were then made by a series of independent

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

judges working without knowledge of control or experimental status.

The majority judgment of three judges was accepted as the Rorschach and MMPI instrument ratings. A sole judge was used with the D-A-P. Maximal instrument agreement constituted a Composite Index rating.

On the basis of each instrument and the Composite Index, subjects were rated in the following categories on three scales:

1. Markedly, Moderately or Not Maladjusted
2. Highly, Moderately or Not Similar to Psychotic Records
3. Prominent, Moderate or No Evidence of Passive Ego Dynamics

Chi Square Established the relative frequency with which control and experimental subjects were placed in these various judgment categories. By then considering Speed of Decision Test scores within each rating scale, group mean differences were examined for significance by analysis of variance. Applying these techniques to each scale in sequence enabled the consecutive testing of the first three hypotheses.

By comparing mean Speed of Decision Test score of five hundred normals with that of the total pathological group, hypothesis IV was tested. By comparing mean score of catatonic and paranoid schizophrenic groups with normal controls, and with each other, hypothesis V was tested.

Results. -- The first three hypotheses were confirmed by each independent instrument and the Composite Index. The fourth hypothesis was not confirmed. The fifth hypothesis was partly confirmed as the catatonic schizophrenic group significantly differed from the control and the paranoid schizophrenic groups. However, paranoid schizophrenics did not differ significantly from controls. It was recognized the psychotic group was perhaps less representative of "psychotics-in-general" than was the catatonic sub-group alone. However, the influence of paranoid schizophrenics was deliberately increased disproportionately to ascertain if it served to attenuate. This suspicion was confirmed. 152 pages. $2.00. Mic 57-3311

AN INVESTIGATION OF THE RELATIONSHIP BETWEEN CREATIVE HUMOR AND AUTHORITARIANISM

(Publication No. 22,223)

Robert Scott Cleland, Ph.D.
The University of Florida, 1957

The California F scale (authoritarianism) and a creative humor test utilizing incomplete cartoons were administered to 188 college undergraduates. Three experimental groups of 20 subjects each were selected, using subjects scoring lowest, medial, and highest (most authoritarian) on the F scale. Cartoon test responses were rated for funniness by seven psychologist judges.

Total humor ratings for the low F scale group significantly exceeded totals for the medial and high groups. However, marked individual variations in humor ratings within each of the F scale groups were also noted. Results were interpreted as tending to support theories which view humor as an index of psychological health as opposed to theories which stress pathological determinants of the humor response. 89 pages. $2.00. Mic 57-3312

DISCIPLINE IN THE HOME: A CONTROLLED OBSERVATIONAL STUDY OF PARENTAL PRACTICES

(Publication No. 22,446)

Edward Clifford, Ph.D.
University of Minnesota, 1957

Adviser: John E. Anderson

Purpose

To describe the disciplinary process as it takes place in the home; to determine the effect of conditions extrinsic to the disciplinary situation possibly causing discipline; to examine conditions of parent-child interaction giving rise to discipline; to determine the effects of discipline on the child.

Sampling

One hundred twenty mothers of children, forty at each of three age levels, three, six, and nine were equally divided within each age level according to the sex of the child. Representation within each age group was equal from groups I and II of the Minnesota Scale for Paternal Occupations.

Procedure

Prior to the observations mothers were interviewed. Data were obtained consisting of background information on the family, estimates of how frequently various disciplinary controls were used, a measure of parental attitudes toward child-rearing practices (Minnesota Scale of Parents' Opinions), and a rating of the child's adjustment by the mother (Personality Profile). One month after the observations, divisions III and IV of the Haggerty-Olson-Wickman Behavior Rating Schedules were filled out for each child. For independent measures of adjustment, teachers filled out identical rating scales before and after observations by the mothers.

Observations were controlled through the use of specially prepared forms. A Daily Information Sheet was filled out once each day for twenty-one consecutive days whether discipline occurred or not. This form provided information about the sleep, health, and activity level of the child, events occurring during the day, unusual circumstances, and the number of hours the child was observed. An Observational Record, filled out for each incident of discipline occurring during the twenty-one day period, described the incident indicating date, time, duration, scene, what the child was doing prior to discipline, difficulty that arose, issue involved, disciplinary controls used and by whom, outcome in terms of the issue, behavior of the child following discipline, and duration of after-effects. Parents had detailed written instructions to assist in filling out forms properly.

Results

1. On all dimensions examined, the primary factor

associated with discipline was the age of the child. Frequency of discipline declined significantly with age (p = .01). Sex and socioeconomic status differences rarely occurred.

2. Discipline arises in situations where the child is concerned with routines of daily living, establishing sibling and adult relationships, and in displaying inappropriate behavior (p = .05 - .001). These difficulties decreased with age (p = .05 - .001).

3. Mothers were most frequently responsible for discipline (72% of the time). Fathers participated to a minimal extent (12%). A great degree of similarity existed between all mothers and all fathers in the use of disciplinary controls (rho = .88). Some data indicated that parents shifted methods used with the age of the child. Multiple rather than single controls were used within an incident, although this tendency declined with age (p = .001).

4. Reasoning was the technique most frequently used at all age levels. Evidence indicated a shift taking place in the use of other techniques from physical techniques to more verbal techniques with age.

5. Discipline occurred most frequently at 8:00 a.m., noon, and from 4:00 - 8:00 p.m. and increased as one peak period succeeded another. No significant differences were obtained for week-ends compared to all other days of the week.

6. Behavior in reaction to discipline tended to be varied, ranging from pleasant, normal behavior to crying and aggressive behavior. The younger child tended to be more variable in behavior than the older child.

7. Correlations between adjustment ratings and discipline (r = -.33 -.55), and parental attitudes and discipline (r = .13 - .28), were low, positive, but not significant.

263 pages. $3.40. Mic 57-3313

DEVELOPING LEADERSHIP IN A SMALL PLANT: A CRITICAL ACCOUNT OF AN EXPERIMENTAL MANAGEMENT TRAINING PROGRAM

(Publication No. 22,195)

Alan Keith Collins, Ph.D.
Cornell University, 1957

This account reports a field study undertaken in an attempt to design and present a management training program embodying the findings of previous research. The study was designed to check whether a training program planned after the leadership climate in the plant had been measured and presented to the entire management group simultaneously could succeed in changing management behavior in desired directions. In deciding what changes in behavior were desirable an attempt was made to identify the organizational effectiveness of different leadership styles.

The Ohio State leadership questionnaires and a Sentence Completion Test devised by the author were the primary instruments used to measure the leadership climate in the plant. The information obtained from the administration of these instruments was supplemented with interview findings and observations made in the plant.

The leadership climate in the plant was surveyed prior to the introduction of the training program in order to identify problems facing management personnel in the plant. A training program designed to meet these problems was then presented to the research and training group which was made up of all the management personnel in the plant.

A post-training evaluation of the outcomes of the training program was obtained by repeating the survey of leadership climate. Comparison of pre- and post-training measures revealed little change in management behavior but did show appreciable changes in attitudes. The changes reflected in the responses to the Sentence Completion Test were greater than the changes reflected in the responses to the Ohio State Instruments. Overall the evidence showed that the objectives of the training program had been partially realized. It was concluded that the methodological approach to management training employed in the study was effective although further research is needed to identify more positively the organizational effectiveness of different leadership styles.

220 pages. $2.85. Mic 57-3314

THE DEVELOPMENT OF EMPIRICAL INDICES OF VALIDITY AND RELIABILITY OF THE PURDUE NON-LANGUAGE ADAPTABILITY TEST

(Publication No. 21,287)

Monte Ford Housholder, Ph.D.
Purdue University, 1957

Major Professor: C. H. Lawshe

Estimates of the validity and reliability of the Purdue Non-Language Adaptability Test based upon industrial, college student, public school student, and foreign language speaking samples were sought.

The Validity Studies. Copies of the NLAT were sent by mail to twelve industrial concerns which administered the test to applicants and employee groups and returned the tests together with criterion data and/or scores obtained by them on other psychological tests. Product moment correlations between NLAT and criteria and between NLAT and other tests were computed.

Concurrent validity coefficients were not statistically significant for the three occupational groups studies: foremen, clerks, and laborers. The highly situational nature of concurrent and predictive validity, however, restrict the extent to which these findings should be generalized.

Correlations between NLAT and a total of 19 other psychological measuring devices were obtained during the course of the study. NLAT was found to correlate most highly with other non-verbal tests of mental ability. The median r between NLAT and non-verbal tests was .524. Next most highly correlated with NLAT were the verbal tests of mental ability with a median r of .446. Mechanical and clerical ability tests follow in that order.

Estimates of the validity of Form F (Form E items with instructions printed in French) were obtained by administering the test to three samples from French-Canadian trade schools. Final achievement test scores were utilized as criteria. The NLAT did not successfully predict the criterion in any of the three groups.

An analysis of the relationship between NLAT score and visual acuity as measured by the Ortho-Rater indicates

that performance on the test is not significantly related to acuity in the normal range.

The Reliability Studies. Four classes of college students were administered the NLAT and retested with different periods of time intervening between first and second administrations. First and second administration scores were correlated to produce coefficients of stability ranging from .678 to .844. Coefficients of stability obtained from two industrial samples were similar in magnitude. It was felt that these estimates demonstrate a sufficiently high degree of reliability to recommend the test for use in industrial employment situations.

The Developmental Studies. The NLAT was administered to approximately 100 public school students in each age group between nine and 17. Examination of the relationship between age and test score indicates that score increases with increasing chronological age up to the mid teens. Beyond this point the curve levels off indicating maturity of the function underlying performance on the NLAT. No systematic differences between the sexes with respect to NLAT performance was noted.

130 pages. $2.00. Mic 57-3315

THE DEVELOPMENT OF A PERSONNEL RATING TECHNIQUE THROUGH THE ANALYSIS OF "WORK PERFORMANCE INCIDENTS"

(Publication No. 22,262)

Robert Donald Kelly, Ph.D.
Purdue University, 1957

Major Professor: Joseph Tiffin

The purpose of this study was to test the hypothesis that a personnel rating technique based on the analysis of "work performance incidents" can be developed such that the resulting technique is valid, reliable, and administratively feasible.

In carrying out the purpose of this research and in looking toward the potential acceptance of this hypothesis, it was anticipated that the introduction of this new concept of rating could make some contribution to the minimizing of subjectivity and maximizing of objectivity in the personnel rating situation.

Work performance incidents, recorded foreman observations of worker activity that are complete in themselves, were available for a representative sample of workers in a mid-western steel company. The incidents represented the observations made on workers in different job classifications in three departments over a period of six months. Over 2,000 incidents were recorded on worker performance records covering nine work categories. The incidents were analyzed in such a way that ranking lists were determined for the men in the different job classifications. Ranking lists based on different methods of analysis of incidents were compared with a criterion ranking list. The criterion ranking list had previously been developed through an excellent company rating plan using the chart system of employee evaluation.

Ranking lists were developed by analyzing the number of favorable and unfavorable incidents for any one worker. A score for each worker was calculated by subtracting the number of unfavorable from the number of favorable incidents. Ranking lists were also developed after individual incidents were weighted as to importance. The incidents were weighted by a method of paired comparisons and also by a method of slotting the incidents into one of four categories of importance. This score for each worker was calculated by subtracting the total weight of all unfavorable from the total weight of the favorable incidents.

The influence of the number of incidents on the validity of ranking lists developed by incident analysis was studied by observing the validity of the ranking list as the average number of incidents per man was varied from twelve to four per man. The influence of the content of the incident on the validity of the ranking was also investigated. The distribution of the weighted incidents among the performance record categories and among workers was studied. The reliability of the rankings was found by comparing individual incident scores from different segments of the rating period. Considering all these variables, specific criteria for technique acceptance were established.

The technique demonstrated validity. The relationship between the incident analysis and the criterion ranking list was high. The relationship was significantly higher when incidents weighted by slotting were used. The technique demonstrated moderately high reliability. It was found that the technique does not appear to maintain satisfactory validity when the incident average per man is under six for the rating period in question. The influence of the number of incidents is evident when it is seen that weighted incidents are evenly distributed among workers and performance categories. Validity was also lowered by an extensive number of identical incidents reported by foremen. The technique demonstrated high face validity and administrative effectiveness.

For the conditions that existed in this investigation and within the boundaries defined by this investigation, the following conclusion can be stated: A personnel rating technique based on the analysis of "work performance incidents" can be developed so that the resulting technique is valid, reliable, and administratively feasible.

48 pages. $2.00. Mic 57-3316

A LONGITUDINAL STUDY OF PURDUE ENGINEERING STUDENTS

(Publication No. 22,271)

William Kerns LeBold, Ph.D.
Purdue University, 1957

Major Professor: H. H. Remmers

This thesis is concerned with the entering freshman class of 1955 in engineering. The purpose of the study was to provide information regarding the following questions:

1. What changes, if any, occurred during the freshman year in the perception of spatial relations and in mathematical and English proficiency?
2. What relationships, if any, exist between freshman engineering grades and such intellectual factors as vocabulary, orientation tests, and high school rank?

3. What relationships, if any, exist between freshman grades and non-intellectual measures such as housing, family income-level, study practices, study conditions, and reported motivation levels?

Five phases are included in the study and are reported independently. They are:

Phase A is a study of the perception of spatial relations.

Phase B is a study of mathematical proficiency.

Phase C is a study of English proficiency.

Phase D is an investigation of the learning process.

Phase E is a study of the relationship between housing and and scholastic achievement.

Of methodological interest, is the empirical comparison of difference scores and "linear estimates of true gains". The reliabilities were found to be consistently higher for the "linear estimates of true gains".

Significant gains were found during the first semester in two-dimensional visualization, as measured by the Revised Minnesota Paper Form Board Test, and three-dimensional visualization, as measured by the Space Relations test of the Differential Aptitude Test Battery.

Significant changes were also noted in mathematics, as measured by the arithmetic and algebra section of the Purdue Mathematics Training Test. Correlations between the difference scores and grades were consistently low or near zero, except for the relationship between grades in a deficiency course in mathematics and gains on the Purdue Mathematics Training Test.

No significant change in English proficiency, as measured by the Purdue Placement Test in English, was found during the first semester; however, a positive relationship was found between the placement tests and grades in English, mathematics, chemistry, and overall grades.

In the learning process phase of the investigation, self-reported high school grades and first semester engineering grades gave significantly higher correlation than high school rank with first semester grades. Income level based on a House-Home Scale, self-reports of motivational level, study conditions, and study practices were found to be unrelated to first semester grades. Knowledge of learning principles and a vocabulary test were found to have a low but positive relationship to first semester grades.

The effect of housing was studied using a single classification analysis of co-variance method. It was found to be a very significant factor when the semester index was used as the criterion and math. orientation tests and high school rank were used to correct for differences in initial ability.

The results were synthesized by means of an intercorrelation matrix. This matrix was based on a sample of 300 students for whom complete data were available.

122 pages. $2.00. Mic 57-3317

THE ROLE OF THE FOREMAN IN MODERN INDUSTRY: SOME CONSIDERATIONS OF MANAGEMENT IDENTIFICATION OF FOREMEN

(Publication No. 21,325)

John Clement Maloney, Ph.D.
Purdue University, 1955

Major Professor: C. H. Lawshe

This thesis in Industrial Psychology is an investigation of foreman's identification with the industrial management group.

An error-choice attitude questionnaire was used to measure the management identification of first line foremen from 28 Midwest industries. Other questionnaires were used to measure the foreman's subjective status attitudes, and the attitudes of the foremen's subordinates toward the foremen. (The error-choice questionnaire also afforded a measure of the foremen's knowledge of current trends in the social, economic and industrial areas.) Supervisors' ratings were used to evaluate the relative productivity of the various foremen's work groups. Other variables studied included the foremen's: organizational level; shift; sex; tenure as foremen; size of work group supervised; age; education; and answers to a straightforward question regarding "the place of the foreman in today's industry."

Among the major findings of this research are the following: foremen's management identification scores (from the error-choice measure) varied considerably and significantly from plant-to-plant; there was, in the total sample studied, a positive relationship between the foremen's management identification scores and the rated productivity of their work groups; the relationship between the foremen's management identification scores and the work group productivity ratings varied from plant to plant (there is a significant interaction effect when management identification scores are classified by plants and productivity ratings.)

The findings of the study are summarized and discussed. Hypotheses are offered to explain the general nature of foreman management identification as well as the plant-to-plant differences in the relationship between foreman management identification and the productivity of the foremen's work groups.

A major hypothesis resulting from this study is that the extent to which a foreman feels that he is a part of management depends largely upon his perception of his chances for success as a manager.

107 pages. $2.00. Mic 57-3318

SOCIOPSYCHOLOGICAL CORRELATES OF AUTHORITARIANISM AND RESPONSE SET IN AUTHORITARIANISM

(Publication No. 22,277)

John Kellogg Meyer, Ph.D.
Purdue University, 1957

Major Professor: H. H. Remmers

A random sample of 4145 students and an accidental sample of about 1300 faculty members were obtained from 21 Indiana universities, colleges, and extension centers and polled on various items concerning the social backgrounds of their lives and on question scales measuring authoritarianism, ethnocentrism, and attitude toward racial and religious discriminative practices. Hypotheses were phrased in terms of intelligence and prejudice, rigidity of thought processes and socioeconomic pressures, authoritarianism and attitude toward classroom discipline, the demographic prediction of differences between authoritarianism and the other scales, faculty authoritarianism and practice in assigning grades, the correlation between faculty authoritarianism and student authoritarianism by departments and by institutions, of the effect of such response sets as acquiescence and tendency to mark extreme alternatives on scale intercorrelation, and of the effects of tendency to leave items unanswered on scale score.

Authoritarianism was predicted with fair success by demographic variables, but this did not always imply prediction of ethnocentrism or prejudice. Some sociopsychological correlates of authoritarianism involved presence in a situation, e. g. a nonaccredited college population, from which removal is not possible except by a major change of life plans. This sort of situation involves recognition of a variety of minority status and leads to liberal views on such matters as prejudice. College students seem also to exhibit a partly authoritarian conformity to certain naive idealisms including such matters as prejudice. These factors appear to have contributed to the differences between demographic prediction of authoritarianism and demographic prediction of prejudice. The only unequivocal predictor of authoritarianism and prejudice found in this study is intelligence.

Student response sets and incompleteness of responses did not affect scale scores. Faculty "Incompleteness" was correlated with presence in authoritarian institutions and presence in liberal departments. Faculty authoritarianism and ethnocentrism were highly intercorrelated over institutions but not over departments. The mean of College Class is higher in teaching fields having nonauthoritarian teaching personnel, suggesting that students tend to leave fields of study where teachers are authoritarian. Grades were negatively correlated with authoritarianism, the more nearly zero correlations being obtained for authoritarian teaching personnel.

Attempts were made at the prediction and interpretation of difference scores (S- and T-scales) obtained by subtracting F-scale score from E-scale score and from D-scale score respectively. The nonauthoritarian extremes of these difference scales may represent ability to think flexibly, if ethnically, in normative terms.

242 pages. $3.15. Mic 57-3319

DEVELOPMENT OF A METHODOLOGY FOR ESTABLISHING VISUAL REQUIREMENTS

(Publication No. 22,240)

Gilbert Edwin Miller, Ph.D.
Purdue University, 1954

Major Professor: Joseph Tiffin

The purpose of this study was: To evaluate a methodology for setting visual standards by determining the relationship between vision and performance on a job-sample test, using subjects possessing a high level of visual skills and reducing their vision using crossed cylinder oblique lenses to obtain the range of vision necessary to determine the manner in which vision is related to job performance.

A job-sample test, consisting of 10 dials contained in an Anti-Aircraft Fire Control Unit, was developed and the performance of 10 subjects on the different dials in the job-sample under 5 artificially induced levels of vision was obtained. Two criteria, time and accuracy of response, were used to measure performance. The reliability of the job-sample test was determined using an odd-even split. The data obtained on the two criteria were analyzed using a facterial analysis of various design.

The results of the analyses indicated vision was significantly related to performance. They also indicated that performance differed significantly on the different dials in the job-sample test. Because of the interaction between vision and dials, the results further indicated results from one dial could not be generalized to predict performance on another dial.

On the basis of the results obtained in the analyses of variance, both time and accuracy performance curves were developed for each dial to describe the relationship between near visual acuity and job performance. Both mathematical and free-hand curves were developed for time performance and free-hand curves only for accuracy performance.

The results of this study indicated the methodology evaluated provides a feasible means for determining the relationship between vision and job-performance which provides a basis from which visual standards can be easily and quickly established. 117 pages. $2.00. Mic 57-3320

DEVELOPMENT OF A SET OF DIMENSIONS FOR DESCRIPTION OF AIR FORCE GROUND CREW JOBS

(Publication No. 22,060)

Raymond C. Norris, Ph.D.
Columbia University, 1957

In any situation where an available man may be assigned to one of several jobs or where an available job can be filled by one of several men, the personnel worker is called upon to make an assignment which will yield maximum job efficiency and/or worker satisfaction. The job assignment has the best opportunity to achieve these objectives if the personnel worker knows what characteristics the job will demand of the worker and the extent to which the available worker possesses them. This study was undertaken to determine which of the many possible

worker characteristics might most usefully be considered in making assignments within the constellation of Air Force ground crew jobs.

A pool of 170 worker characteristics which might be used in making job assignments was assembled from current job analysis schedules, from factor analytic studies, and from the field of military psychology. The extent to which each of these characteristics was called for in each of 150 representative ground crew jobs was rated by two experienced vocational counselors. The ratings were obtained by having the vocational counselors read a job description and then rate each characteristic on the level at which it was required by the job and the extent to which more than the required level of the characteristic would be helpful. The 40 items which were not generally applicable to the sample of jobs, did not discriminate between jobs, or were not reliably rated were dropped from further consideration.

Product moment correlation coefficients among the 130 worker characteristics which were retained from the initial screening process were determined. This 130x130 matrix was factor analyzed by a modification of the diagonal method which made it possible to do the analysis on an electronic computer. Twenty-five orthogonal factors were extracted and rotated to simple structure. Eleven factors seemed well enough defined to be considered job dimensions which would be useful in analyzing Air Force ground crew jobs.

When only 11 factors were taken into consideration, it was found that many variables had substantial portions of their reliable variance unaccounted for. Through multiple correlation techniques, seven additional dimensions were added. These dimensions were defined by single variables which were relatively independent of the variables chosen to represent the 11 definable factors and of each other.

The total list of worker characteristics recommended for use in analyzing Air Force ground crew jobs consisted of the abilities to:

1) Operate fixed position controls with speed and accuracy,
2) Manipulate objects skillfully,
3) Coordinate foot movements with hand movements,
4) Reason inductively,
5) Adapt to situations calling for social and professional contacts with a wide variety of people and situations,
6) Assume responsibility for and manage the activities of others,
7) Speak well and enjoy work with people,
8) Understand the construction and functioning of a wide variety of machines and hand tools,
9) Interpret maps, diagrams, charts, and other spatial patterns,
10) Change the way in which a stimulus or situation is viewed in order that flexibility of approach may be obtained,
11) Perform work calling for strength and endurance,
12) Concentrate on a job in the midst of noise, interruptions, and other distractions,
13) Work accurately through possessing the necessary sensory acuity and the personal attribute of carefulness,
14) Work efficiently under physically hazadous conditions,
15) Exhibit speed in making decisions or in performing tasks,
16) Control the expression of emotions and work effectively in emotion-provoking situations,
17) Perceive pertinent detail in verbal or tabular material, and
18) Perform arithmetic operations quickly and accurately.

136 pages. $2.00. Mic 57-3321

THE EFFECT OF CONSISTENT AND INCONSISTENT PUNISHMENT ON THE EXPLORATORY BEHAVIOR OF THE WHITE RAT

(Publication No. 22,232)

Stanley Spiegel, Ph.D.
The University of Florida, 1957

The present study was designed to measure the effect of consistent and inconsistent punishment on exploratory behavior. It was hypothesized that punishment would result in fear and timidity which would restrict activity, and that inconsistent punishment would have a more detrimental effect on exploration than consistent punishment.

The major piece of equipment utilized was a punishment board six feet in diameter and covered with concentric tracks of copper sheeting. The board was electrically wired so that a shock of increasing intensity could be given for greater exploration. Rats could avoid shock by remaining in the safe central area, which was always at least fifteen inches in diameter. Wiring also provided the differential application of shock from the tenth, fifteenth, and twentieth track to the periphery, including the fence. The second piece of equipment was a square transfer board upon which was penciled a grid-like pattern.

Recording equipment took the form of mimeographed sheets duplicating the pattern of the boards, and a map-tracing device. This provided a permanent record of the distance traversed by each animal.

One hundred two male rats of the Charles River Sprague-Dawley strain, sixty-two days old at the time of the experiment, were used. Animals were randomly assigned to four different groups: A consistently punished group, an inconsistently punished group and two control groups, each made up of approximately twenty-five animals.

Animals were housed six to a cage and provided with adequate food and water so as to prevent hunger or thirst from acting as motivating drives in the experiment.

On the punishment board all animals received two one-minute trials per day under different conditions: Consistently punished animals received a shock on every trial, inconsistently punished animals were shocked in a random manner.

Twenty-four hours after their final trial on the

punishment board, each animal commenced trials on the transfer board. As with the punishment board, each animal was permitted two one-minute trials daily. All animals regardless of group affiliation were run a total of sixteen trials on the transfer board.

Specifically, the experiment was designed to test the following hypotheses:

1. Rats which have been punished for exploration will explore less in a later transfer situation than rats which received no punishment for exploration.
2. Rats which have been punished inconsistently for exploration will explore less in a later transfer situation than rats which have been punished consistently for exploration.

Results of the experiment substantiated both hypotheses.

55 pages. $2.00. Mic 57-3322

PSYCHOLOGY, CLINICAL

EFFECTS OF MOTIVATING INSTRUCTIONS ON REACTION TIME IN CEREBRAL DISEASE

(Publication No. 22,071)

Harold Lawrence Blackburn, Ph.D.
State University of Iowa, 1957

Chairman: Professor Arthur L. Benton

The main purpose of the present study was to determine the RT responsiveness of hospitalized, non-psychotic patients with supratentorial cerebral disease or injury to three types of motivating instructions and to compare their performances with those of a similar group of hospitalized medical patients without cerebral disease. Some secondary interest was attached to initial differences between these groups in absolute level of RT performance and to trends in performance over trials within the various diagnosis-instructions treatment combinations.

Patients were assigned to the two diagnostic groups on the basis of final medical evaluation, a total of 78 brain-damaged Ss and 117 control Ss being retained in the present study. Within the limits imposed by the maintenance of proportionality with respect to sex and hospital residence, Ss within each diagnostic category were assigned randomly to the three instructional categories, viz., standard, relaxing, urging. Initially, 30 visual choice RT trials were administered to each S under standard conditions. This was followed by differential instructions and by 30 post-instructional trials. The criterion score for each S was the difference in total time scores between his 30 pre-instructional and 30 post-instructional trials.

The following results were obtained:

(1) The null hypothesis with respect to a diagnosis-instructions interaction was rejected.

(2) Under standard instructions, a significant difference in mean criterion score was found between brain-damaged and control Ss, with brain-damaged Ss showing a post-instructional decrement in performance and control Ss an increment.

(3) Under both the relaxing and urging instructions, brain-damaged Ss showed an apparently greater mean increment in criterion score than control Ss, but neither of these differences was significant.

(4) Within each diagnostic group, a significant main effect for instructions was found.

(5) Urging instructions resulted in the greatest gains in performance within each group of Ss and were significantly different in their effects from each of the other two instructional conditions.

(6) Among control Ss, the relaxing instructions resulted in an apparent post-instructional increment in performance which was practically identical in size with the increment shown by these Ss under the standard instructions condition. Brain-damaged Ss also showed an increment under the relaxing condition and this was in contrast to the observed decrement for this group under the standard condition. However, the effects of relaxing instructions were not significantly different from the effects of standard instructions within either diagnostic group.

(7) Brain-damaged Ss were significantly slower than control Ss in absolute levels of initial RT performance.

(8) Amount of gain in performance was not found to be significantly related to initial levels of performance within any of the six diagnosis-instructions treatment combinations.

(9) Prior to differential instructions, practice effects for both diagnostic groups were minimal, with control Ss showing little or no change and brain-damaged Ss showing slight decrements over blocks of trials.

(10) Following differential instructions, changes over blocks of trials were minimal for each of the six diagnosis-instructions treatment combinations, suggesting that whatever the instructional effects may have been, they operated uniformly over the post-instructional trials.

58 pages. $2.00. Mic 57-3323

PREDICTIVE FACTORS IN THE INITIAL INTERVIEW IN FAMILY CASEWORK

(Publication No. 21,775)

Margaret Blenkner, D.S.W.
Columbia University, 1957

The major goal of this study was to determine the extent to which knowledge of factors obtained in the first interview with a client might enable one to predict the change that would occur in a client and his situation by the time his case was closed. The basic methods used were those of test construction developed in the field of educational psychology. The study was conducted at the Institute of Welfare Research of the Community Service Society of New York. The sample, which was randomly divided into two sub-samples for cross-validation, consisted of all the

new cases opened in the district offices of the Society in a specific month.

One team of three experienced caseworkers made judgments regarding a large number of items from the case record of the first interview. Those items on which sufficient evidence was available for judgment in all or nearly all cases and which had sufficient reliability and variability to indicate potential predictive value were analyzed in the light of two criteria: (1) whether or not the client continued for more than one interview and (2) whether or not positive movement occurred. Movement was scored by reading the entire case record and applying the Movement Scale developed at the Institute by J. McV. Hunt and his associates as a standardized and highly reliable measure of change in the client and/or his situation.

Four factors were found to operate selectively in determining which clients continued beyond the first interview and for whom judgments of movement were thereby possible. These factors were: (1) the problem with which the client sought help, (2) the client's response to the worker's proposals or suggestions for solution or alleviation of the problem, (3) the client's conception of the worker's role at the beginning of the interview, and (4) the client's acceptance of the worker in a counselling role by the end of the interview. For those clients who continued contact for at least two interviews, five factors were found which, used as a battery, indicated that it is possible to make moderately successful predictions regarding positive movement during the course of contact with the agency. The cross-validation in this study, however, is only partial. That is, while the several items, considered separately and independently, were cross-validated, the battery could not be, inasmuch as it was derived from those items which stood the test of validation in both samples.

The five factors associated with positive movement were: (1) the source of the client's contact with the agency, (2) agreement between the area of the client's problem as he presented it and as a judge diagnosed it, (3) insight of the client, (4) resistance to discussion of the problem, and (5) the degree to which the client was overwhelmed by the problem. In contrast to the moderately successful prediction of positive movement through a composite score based on these factors, clinical predictions made by experienced workers through perusal of the record of the first interview were found to be without validity; there being high probability that such success as was achieved could occur from chance alone. More intensive research in this area should be profitable. The ability to predict expected outcome in a case under given circumstances early in the casework process (differential prognosis) would be of great value to the intake worker in arriving at disposition of the case, to the supervisor in assigning cases, and to the administrator in determining what services should be offered and where special experimentation and study should be focussed. 100 pages. $2.00. Mic 57-3324

A STUDY OF THE RELATIONSHIP BETWEEN WITKIN'S INDICES OF FIELD DEPENDENCY AND EYSENCK'S INDICES OF NEUROTICISM

(Publication No. 22,247)

Mae Matthisen Bound, Ph.D.
Purdue University, 1957

Major Professor: Lawrence M. Baker

This study was designed to investigate the relationship between Witkin's continuum of field dependency and Eysenck's dimension of neuroticism. In addition an attempt was made to determine the role of intelligence in these two dimensions.

Three of Eysenck's objective behavior tests (static ataxia, suggestibility, and tweezer dexterity) were selected to represent his indices of neuroticism. Witkin's group of tests that reveal field dependency were represented by two of his perceptual tasks (series 3 of the rod-and-frame test and the embedded figures test). The Otis S-A test provided the measure of intelligence.

The intelligence test was given to five sections of an introductory psychology course during their regular class hour. One hundred men were then randomly selected from this larger group to serve as subjects for this experiment. The rest of the tests were individually administered to each subject in a fixed sequence during one testing session.

The hypothesis stated that there is a relationship between Witkin's tests of field dependency and Eysenck's indices of neuroticism. The scores of Witkin's two tests were combined with equal weight to arrive at the perceptual index for each subject. The scores of Eysenck's three tests were combined in the same fashion to form a neuroticism index.

A product-moment correlation between these two index scores (.066) failed to support the hypothesis that the two series of tests are related. Nor was there any evidence of a curvilinear relationship. A significant, but low, correlation (-.24) was found between the perceptual index and intelligence. Intelligence seemed to have no relationship to the neuroticism index ($r = -.039$) in this study.

A correlation matrix of each test with every other test revealed that the two tests comprising the perceptual index had a significant, but low, correlation (.35). This value is considerably lower than the correlation of .76 that Witkin reported between these two tests for a comparable population. The tests comprising the neuroticism index showed negligible correlations with each other.

This matrix also revealed that the relationship between the perceptual index and intelligence, mentioned above, was due to the correlation between intelligence and the embedded figures test (-.32) only. The rod-and-frame test seemed to have little relationship to intelligence.

These results did not agree with the original findings of Witkin and Eysenck. Thus, the results of this experiment not only failed to support the hypothesis that Witkin's tests of field dependency are related to Eysenck's indices of neuroticism, but also failed to replicate the findings upon which this hypothesis was based. Similarly, the relationship between intelligence and the perceptual tests found in this study is considerably lower than that found by previous investigators.

A number of possible explanations for these differences were advanced. It was concluded that further research on

the reliability and generality of the findings reported by Witkin and Eysenck is desirable before we use their findings as stepping-stones to new hypotheses.

69 pages. $2.00. Mic 57-3325

AN INVESTIGATION OF MANIFEST ANXIETY AND THE ROLE OF DISCRIMINATION IN SELF-IDEAL DISCREPANCY AND COMPLEX TASKS

(Publication No. 21,906)

Bernard David Branson, Ph.D.
Syracuse University, 1957

The purpose of this study was to examine the relationship of manifest anxiety and the capacity of individuals to discriminate between the self and ideal, and to discriminate in complex tasks.

It was felt if one accepted the Client-Centered rationale, that the discrepancy between the self and ideal reflected a sense of self dissatisfaction, then this could be manifested as anxiety. The wider the discrepancy, the greater the anxiety.

However, if one also accepts the hypothesis put forth by the learning theorists, that anxiety blends into fear when the visceral components are present in an extreme degree, this anxiety would interfere with thinking, and, consequently, it would interfere with discrimination. Thus, the very fearful or High Anxious person would not be able to discriminate between his self and ideal, compared to a Moderately Anxious or Low Anxious person.

Therefore, this research attempted to test the hypothesis that the High Anxious group, as measured on the Taylor Anxiety Scale, would show less self-ideal discrepancy, compared to a Middle Anxious group; and the High Anxious group would also show less discrimination on two complex judging tasks, an impersonal and interpersonal task. A further hypothesis tested was that the Middle Anxious group on the A Scale would show a larger self-ideal discrepancy compared to a Low Anxious group, but would be discriminating no poorer than the Low Anxious group on both complex judging tasks.

The subjects were 122 graduate and undergraduate students at Syracuse University. They were administered the Secord and Jourard Self Concept Test, The Minnesota Paper Form Board, and the Picture-Frustration Identification Test. Of the initial group, 35 males and 87 females satisfied the criteria for inclusion in the study. Data were obtained on the measures of performance, and "t" tests were performed between the High Anxious and Middle Anxious groups; the Middle Anxious and Low Anxious groups; and the High and Low Anxious groups.

The anxiety groups were chosen on the basis of scores on the Taylor A Scale. The upper and lower 14 percent were the High and Low Anxious Groups respectively. The Middle Anxious group was the 14 percent which fell in the center, and included the mean and median of Taylor's original data.

The results obtained were as follows: 1. The self-ideal discrepancy of the High Anxious group was significantly greater than that of the Low Anxious group, but not significantly different from that of the Middle Anxious group. 2. The self-ideal discrepancy of the Middle Anxious group was not significantly different from the self-ideal discrepancy of the Low Anxious group. 3. There were no significant differences in the performance of the High, Middle and Low Anxious groups on the Picture-Frustration Identification Test. 4. The performance of the High Anxious group was significantly poorer than that of the Low Anxious group on the Minnesota Paper Form Board, but not significantly different from the performance of the Middle Anxious group. 5. The performance of the Middle Anxious group was significantly poorer than that of the Low Anxious group on the Paper Form Board.

The general conclusion suggested by this study appears to be that discrimination in complex tasks begins to show impairment at levels which could be called Middle anxiety, as measured by the Taylor scale. Beyond this point, greater amounts of anxiety do not appear to affect discrimination to any greater degree, within the limits of this investigation.

Discussion of the results centered upon the relevancy of the findings to previous research in the area of anxiety. The implications of the influence of defense mechanisms, the instruments used, and the presence of varying amounts of anxiety were discussed with reference to the problems of assessment of performance and for research. Finally, this study was viewed from the standpoint of suggestions for future research, and the likely areas which it was felt may make an important contribution to the further clarification of the effects of anxiety upon discrimination.

141 pages. $2.00. Mic 57-3326

WORD ASSOCIATION RESPONSES IN RELATION TO READING ABILITY

(Publication No. 22,347)

Carol Jane Geier, Ph.D.
The University of Wisconsin, 1957

Supervisor: Associate Professor Gwen F. Arnold

The primary purpose of the study was to investigate certain aspects of word association responses in relation to reading ability. Word association responses are examined from the standpoint of 1) quality of response, determined by certain classificatory principles; 2) speed of response, determined by reaction time on the word association test and by performance on a word fluency test; 3) commonality, a measure of which is derived from a frequency table of responses obtained in the study; and 4) emotionality. The latter is limited to one type of physiological change which has been found to accompany emotion, namely, the change in electrical skin potential. This phase of the study is concerned with the base level of skin conductance and the transitory change which occurs under emotional stimulation known as the galvanic skin response (GSR). A measure of this and of base level is obtained in connection with the administration of the word association test. Specific aims of the study are 1) to establish a difference between good and poor readers in quality of response on the word association test, speed of reaction, frequency of response, base level of skin conductance, and galvanic skin response; 2) to determine sex differences in these aspects of word association; 3) to establish a

relationship between speed of response and electrodermal skin phenomena; and 4) to establish a relationship between speed of response and frequency of response.

The experimental group consists of twenty-four fourth grade children, an equal number of boys and girls, whose reading achievement was at least one-half year retarded from grade placement. They range in age from 112 to 126 months with a mean of 117.5 months. They were selected at random from groups of children in three urban and three suburban schools who showed retardation on a standardized reading achievement test. These experimental subjects are matched closely with average or better than average readers on the bases of chronological age, school, sex, and vocabulary level. This constitutes the control group. A word association test was administered individually to the 48 subjects and a continuous galvanic skin response record was made simultaneously. Scores on ten variables were obtained: Reaction Time, Frequency, Word Fluency, Quality (five classifications), Base Level of Skin Conductance, and Galvanic Skin Response. An analysis of variance was used to determine significant differences among the means of the four groups (good readers, boys; good readers, girls; poor readers, boys; poor readers, girls) on the above variables.

Significant intergroup differences were found in 1) length of time required to respond associatively; poor readers respond more slowly than good readers; 2) quality of response, namely, degree of generalization; those who have achieved successfully in reading give more generalized responses; and 3) frequency or commonness of response; poor readers give more individual or infrequently given responses. No significant intergroup difference in word fluency was obtained; those retarded in reading do as well on continuous free association as do better readers. There was no significant sex difference for any of the variables. Evidence of emotionality accompanying word association could not be established with the method of measurement employing galvanic skin response and base level of skin conductance. No significant relationships were found between reaction time and base level skin conductance, reaction time and word fluency, or reaction and frequency of response.

The conceptualization process involved in word association was interpreted as requiring more time in some individuals than in others. Below average readers are inferior in this ability and therefore require more time to respond and also give more uncommon responses, according to the interpretation of the above findings.

120 pages. $2.00. Mic 57-3327

THE RELATIONSHIP BETWEEN COPING AND AVOIDING BEHAVIOR AND ATTITUDE MODIFICATION

(Publication No. 22,167)

Michael Joseph Goldstein, Ph.D.
University of Washington, 1957

This study was concerned with the response to fear arousing propaganda of two groups of subjects who characteristically use very different means of dealing with fearful material. The two groups were called copers and avoiders. Copers are people who are able to admit their feelings, both pleasant and unpleasant, and deal with them directly. Avoiders avoid the recognition of their feelings, pleasant and unpleasant, and use mechanisms such as repression to forget about unpleasant stimuli. The two groups were selected on the basis of their Sentence Completion Test responses. Each subject received one of two propaganda lectures, a strong fear appeal or a minimal fear appeal. These lectures were varied according to the number of threat references which they contained and the nature of the accompanying slides.

The results supported the hypothesis that a strong fear appeal would be more effective with copers than avoiders, while the minimal fear appeal would be more effective with avoiders than with copers. The hypothesis that the differences in the effectiveness of the two appeals would be explained on the basis of differential recall of the content of the lectures by copers and avoiders was not confirmed. The reason for the differences in effectiveness thus still remain unclear.

An investigation of the correlates of the coping-avoiding dimension revealed that scores on this dimension were independent of social desirability. However, it was found that copers tended to score higher on the sex and aggression variables of the Edwards Personal Preference Schedule. This suggested that copers and avoiders were relatively consistent in their tendencies to recognize or to avoid recognition of disturbing feelings.

105 pages. $2.00. Mic 57-3328

A PSYCHOLOGICAL STUDY OF THE EFFECTS OF REGRESSIVE ELECTROSHOCK THERAPY

(Publication No. 22,452)

Patricia Eileen King-Ellison Good, Ph.D.
University of Minnesota, 1957

Adviser: Wallace A. Russell

Twenty-seven psychiatric patients who had undergone Regressive Electroshock Therapy (REST) at the University of Minnesota Hospitals were studied relative to changes occurring in conjunction with REST.

Temporary and long-term personality changes were studied by means of the Minnesota Multiphasic Personality Inventory (MMPI). Significant changes between admission and discharge profiles were noted on scales: F, K, 1, 2, 3, 4, 6, 7, 8, Si and Es. A comparison of admission and follow-up profiles for 18 of the patients indicated significant differences on scales F, 2, 3, 7, Si and Es. It was concluded that positive personality changes do occur in connection with REST and these changes persist to some extent after discharge. Although the basic personality configurations did not appear to change, there was some shifting from psychotic to neurotic profile types.

Changes in general intellectual level were evaluated by the Wechsler Bellevue Intelligence Scales and the Shipley-Hartford Scales. Although the follow-up test scores were somewhat higher, the differences were not statistically significant.

Temporary changes in intellectual efficiency that might suggest organic brain damage were studied two to three weeks after the termination of REST using the Wechsler

Memory Scales, the Porteus Mazes, the Graham-Kendall and the Archimedes Spiral. Positive changes were found only on the Graham-Kendall, a fact suggesting some organic cerebral involvement at that time.

Long-term changes in intellectual efficiency were studied by the above tests as well as the Partington Pathways, the Knox Cubes, and the Memory-for-Objects test. Decrements on the Information and Similarities sub-tests of the Wechsler-Bellevue suggested a loss in some previously learned verbal material. There were no other indications of permanent organic brain damage in the test results, and some improvement in general intellectual efficiency was suggested.

The Wechsler Memory Scales, the Knox Cubes and the Memory-for-Objects tests were also considered separately as measures of memory functioning, and changes on the first two tests were noted as suggesting improvement.

Individual items on the Briggs History Questionnaire were studied to compare the REST patients and Briggs' psychiatric norm group. The group differed on items relating to socio-economic status, educational and intellectual level, and health problems. In addition scores were obtained on three provisional scales, and the REST patients were seen to differ on the Hypochrondriacal scale.

A group of nine patients showed less improvement by the time of discharge than the other 18 patients. It was found that this "non-improved" group represented the extremes of the age distribution for the total group. Lower "ego strength" (ES) scores on the MMPI as well as non-deviant scores on scale 9 of the MMPI and the Hypochondriacal scale of the Briggs questionnaire were suggested as possible indicators of better prognosis for REST.

In conclusion, it appears that improvement on personality variables does occur in connection with REST, and this improvement appears to have some relative stability. Long-term detrimental effects of REST related to lower intellectual level, loss of memory ability, and organic cerebral deficit were not found. However, some temporary organic deficit was noted three weeks after REST, and a loss of previously learned verbal material was also suggested. Otherwise, the results suggested improvement of intellectual efficiency. History variables distinguishing REST patients were noted, and differences between "improved" and "non-improved" patients were found which might serve as bases for future research.

88 pages. $2.00. Mic 57-3329

SOME ASPECTS OF RELATIONSHIP BETWEEN MOTOR COORDINATION AND PERSONALITY IN A GROUP OF COLLEGE WOMEN

(Publication No. 21,117)

Martha Jaeger, Ph.D.
Columbia University, 1957

This research project was set up in 1931. In 1939 the dissertation was presented and the oral examination passed. Due to several unforeseen events, the dissertation was not prepared for publication. The revision, therefore, has had to be very extensive, in the light of the many changes that have occurred in psychological research during these twenty-five years.

A very brief summary of the major changes in psychology in this period takes place of the more detailed historical approach in the first formulation.

This study was part of a larger research project of a mental hygiene department newly organized in a teachers' training college to study the adjustment problems of college women. The writer chose for her specific problem of investigation some possible relationships between motor coordination and temperament aspects of the personality. The test used were:

1. Bernreuter Personality Inventory
2. Minnesota Personal Traits Rating Scale
3. Watson Self-Estimate of Happiness
4. Brace Motor Test
5. McQuarrie Mechanical Aptitude Test
6. Whipple Reading Test
7. Health and Speech Tests
8. Individual Interviews
9. Counselor's Ratings on the following items
   a. Aggressiveness
   b. Dominance
   c. Self Sufficiency
   d. Motor-Coordination
   e. Heterosexual Adjustment
   f. General Social Adjustment

The statistical data have been condensed but are sufficiently complete to show that accepted research techniques were used. These data are treated on three levels: First, a statistical treatment of the total group; second, an analysis of the fifteen extreme cases at each end of the distribution of the Bernreuter Introversion-Extraversion Scale, the Brace Motor Test and the McQuarrie Mechanical Aptitude Test; third, seventeen cases from the extreme groups are presented with more detailed analysis.

No significant data came from the statistical treatment of the total group. The study of the extremes appears to indicate three patterns relating particularly to large muscle coordination, height-weight ratio, introversion-extraversion and certain other temperament factors; namely, dominance, aggressiveness and social adjustment. These three patterns appear to have a distinct relationship to Sheldon's trichotomies of physique and temperament.

While the case studies appear to bear out the thesis that there are definite configurational trends involving motor coordination and temperament, the more important evidence is to see that the dynamic pattern is unique for every individual. The writer has attempted to show the dynamic use that each individual makes of the psychophysical pattern in which she appears to fall. The general conclusions may be briefly stated:

1. There are basic universal factors in the relationship between expressive movement and psychophysical structure.
2. The relationships can be investigated wherever a continuous distribution of measurable elemental components can be determined.

3. There is a trichotomy of configuration in the basic relationship of these components.
4. This investigation appears to uphold the trichotomy of pattern established by Sheldon in his study of varieties of human physique and temperament.
5. This study gives evidence for supporting Jung's theory of introversion-extraversion and its functioning in ego formation.
6. The triad structuring is particularly significant in the developmental process of the individual ego formation.

99 pages. $2.00. Mic 57-3330

A COMPARISON OF PARENTAL ATTITUDES OF MOTHERS OF SCHIZOPHRENIC, BRAIN INJURED, AND NORMAL CHILDREN

(Publication No. 21,593)

Lewis Bernard Klebanoff, Ph.D.
Boston University Graduate School, 1957

Major Professor: Professor Charles N. Leef

A review of the literature on childhood schizophrenia reveals a bipolar difference of opinion concerning etiology. One opinion is that the impact on the child of the mother's behavioral expression of pathological attitudes toward child rearing and the family brings about a schizophrenic reaction; the other opinion is that there is an as yet undiscovered organic reason for the child's symptoms and that pathological attitudes observed in the mother arise as a result of the stress of trying to deal with the disordered child. The present study is designed to compare maternal attitudes of mothers of schizophrenic children, mothers of similarly behaving retarded and brain injured children, and mothers of normal children.

The subjects were 15 mothers of hospitalized schizophrenic children with certain speech and behavior symptoms, 15 mothers of hospitalized brain injured and retarded children with similar behavior symptoms, and 26 mothers, all of whose children are and have been free of any serious chronic disorder.

The Parental Attitude Research Instrument, developed by Schaefer and Bell at the National Institute of Mental Health, a paper and pencil questionnaire consisting of 23 five-item scales, was administered to each subject. Personal data about the age of the mother, her education, religion, husband's occupation, number of children, and family medical history was obtained from each mother after she had finished the PARI.

The results support the hypothesis that the mothers of schizophrenic children do not display more pathological attitudes than mothers of similarly behaving organic children, but that both groups have more pathological attitudes than mothers of normal children.

The results support the hypothesis that the mothers of schizophrenic children do not display more pathological attitudes than the mothers of organic children on any of the five factors into which the PARI was analyzed, but that both groups have more pathological attitudes with respect to "Over-possessiveness" than mothers of normals.

There were no significant differences between the attitudes of groups S and O on the variables of age of onset of the child's symptoms, age at time of hospitalization, sex of the patient, whether patient was first-born child, and whether the mother had subsequently had a normal child.

The results further show that in addition to the differences among the groups based upon the condition of the child, the mothers' attitudes also varied according to their education, religion, and socioeconomic grouping.

The findings tend to support the general hypothesis that mothers who are faced with comparable disturbed behavior will manifest comparable attitudes toward child rearing and the family and will manifest more pathological attitudes than mothers of normal children who present no special problem. The findings cast doubt upon the hypothesis that maternal attitudes are the cause of childhood schizophrenia. The likelihood of observed maternal attitudes being a combination of prior and reactive attitudes was discussed. The fact that within each group were mothers with widely disparate attitudes was also discussed. Also noted was the possibility that the severity of symptoms of the organically ill children might not be solely the result of organic factors.

The merits of the "spectrum" idea of causation of childhood schizophrenia were highlighted. According to this notion, organic predisposition would occupy one end of the scale and psychological traumata the other. Either extreme or any combination might precipitate the same clinical pattern in different children.

It was suggested that intensive investigation might disclose that the characteristics thought to be peculiar to mothers of schizophrenic children may be shared by many or all mothers of severely disordered children.

140 pages. $2.00. Mic 57-3331

A STUDY OF SOME PERSONALITY FACTORS ASSOCIATED WITH RESTRUCTURING OF ATTITUDES

(Publication No. 22,272)

Victor Samuel Lebow, Ph.D.
Purdue University, 1957

Major Professor: Franklin J. Shaw

This study was concerned with the tendency of individuals to construe information in a characteristic fashion. Five hypotheses were developed which related perceptually-defined personality factors to modes of construing information. These hypotheses were:

(1) Although other studies have shown that perception of movement in ambiguous still figures, e.g., the Rorschach plates, is inversely related to the amount of overt activity, it was postulated that this perceptual tendency would be associated with the tendency to construe information as sanctioning action.

(2) Since the capacity for delay of motor activity is associated with the tendency to perceive movement in ambiguous still figures, the tendency to perceive movement was expected to be associated with the judgmental activity involved in evaluating and assimilating factual material.

(3) Since responsiveness to color and permeability of the ego to the environment have been considered related

phenomena it was expected that individuals with a preponderance of color-dominated (CF) responses over color-subordinated (FC) would more easily acquire factual material.

(4) Although color-dominated responses are ordinarily considered as indicative of impulsiveness and acting, it was postulated that action concepts would not be differentially perceived by color-dominated people; it was hypothesized that color-dominated people would not differ significantly from color-subordinated people in respect to construing information as sanctioning action.

(5) As a consequence of the avoidance and distortion of information associated with certain defense mechanisms, it was postulated that a relatively extensive use of these mechanisms was negatively associated with acceptance of factual material having emotional significance.

To test these hypotheses, 54 psychiatric nurses and aides in a lecture course on mental illness were administered the Mental Illness Attitude Scale (MIAS), a test devised by the author, before and after the course. The Harrower Multiple Choice Test (MCT) was administered about midway in the course. Two subscales derived from the MIAS, factual and action, were used to measure the relative acceptance of factual material during the course and to measure the degree to which information had been construed as sanctioning action. Human movement and color responses for each subject were based on score values assigned the MCT by experienced Rorschach examiners. The defensiveness measure was a composite score made up of rejections, X-ray responses, oligophrenic details, shading rejection, and attribution of unpleasant qualities to the blots.

Hypothesis 1 was supported at the .05 level of significance. Hypothesis 4 was supported in that there was no significant difference between color-dominated and color-subordinated groups, but it should be noted that establishing lack of relationship on the basis of "proving" the null hypothesis is quite tenuous. The results for Hypothesis 5 were highly suggestive of the predicted relationship, the differences between high and low defensive groups barely failing to reach the .05 level. Hypotheses 2 and 3 were not borne out by the analysis.

It was concluded that the study had demonstrated some support for the premise that there are relatively general patterns underlying the manner in which information is construed. It was suggested that the measures of the perceptual aspects of these patterns, as well as the measures of attitude change, were not sufficiently precise.

75 pages. $2.00. Mic 57-3332

AN EXPERIMENTAL STUDY OF AMBIGUITY TOLERANCE AS A TRAIT

(Publication No. 21,104)

Perry Joseph Rushlau, Jr., Ph.D.
University of Missouri, 1957

Supervisor: Dr. Robert S. Daniel

The purpose of this experiment was to provide evidence for the status of ambiguity tolerance as a personality trait. Ambiguity tolerance was defined as the capacity, inferred from behavior, to endure and deal with situations and relationships the structure of which was not clear.

The specific hypotheses which were submitted for testing were these:

1. Under controlled conditions, subjects differentiated with respect to test behavior defined as tolerance-intolerance for ambiguity would demonstrate concomitant variation of behavior on a series of tasks believed to bear a relationship to ambiguity tolerance.
2. Manipulation of the degree of ambiguity in instructions for the performance of a series of experimental tasks would produce significant variation in performance on those tasks.

The subjects were 76 undergraduate psychology students at the University of Missouri.

These hypotheses were tested in a three-way analysis of variance, repeated for each experimental task. The experiment was conceived as a 2 x 2 x 4 factorial design. The factors which were studied were tolerance-intolerance for ambiguity, defined in terms of extreme performance on the Berkeley Questionnaire, and treatment (structured versus unstructured presentation) of instructions for performance of experimental tasks.

The dependent variables were the scores of the subjects, under varying conditions of presentation on seven tasks: (1) art preference, (2) humor preference, (3) generalization, (4) verbal concept formation, (5) figure relationship, (6) syllogistic reasoning, and (7) problem-solving.

Significant differences were found between the ambiguity-tolerant and ambiguity-intolerant groups in scores on tests of humor preference, generalization, figure relationship, and problem-solving. The kind of test instructions showed an effect in scores on tests of figure relationship and problem-solving. A concept formation test distinguished only between groups differing in intellectual ability. Tests of art preference and syllogistic reasoning did not produce any differences among experimental groups.

This covariance was interpreted as providing an empirical basis for the concept of ambiguity tolerance as a trait, and for the Berkeley Questionnaire as a measure of this trait.

128 pages. $2.00. Mic 57-3333

AN EXPERIMENTAL INVESTIGATION OF THE RELATIVE CONTRIBUTION TO CLINICAL DIAGNOSIS AND PERSONALITY DESCRIPTION OF VARIOUS KINDS OF PERTINENT DATA

(Publication No. 22,476)

Lloyd K. Sines, Ph.D.
University of Minnesota, 1957

Adviser: Dr. William Schofield

The purpose of the present study was to evaluate the usefulness of several kinds of data in terms of their contribution to accurate descriptions of psychiatric patients' personality characteristics. The following major hypotheses

were tested: 1) clinicians are able, on the basis of autobiographical, interview, and psychological test data, to describe patients more accurately than does a stereotyped personality description, 2) the data employed are of differential value in terms of their contribution to diagnostic accuracy, 3) there is a positive relationship between the amount of data and the accuracy of the clinician's descriptive (diagnostic) statements, 4) clinicians differ with respect to their diagnostic skill, and also 5) with respect to their success with specific data types.

The subjects studied were thirty male veterans receiving outpatient psychiatric treatment. Approximately one-fourth of the patients had a diagnosis of some type of psychosis, while the remainder had diagnoses other than psychosis, primarily psychoneurosis. The patients as a group were 1) more intelligent and 2) better educated than the clinic population in general.

The procedures followed were essentially three: 1) initial psychodiagnostic evaluation, 2) ten hours of individual psychotherapy, 3) subsequent evaluation by the psychotherapist. Each patient filled out an autobiographical data sheet, completed the booklet form of the MMPI, was given a Rorschach test, and was interviewed by the clinician who analyzed and evaluated the other data. The four kinds of data were analyzed separately and in a specified order by a clinical psychologist trainee who, after considering each data source, performed a Q-sort of 97 statements describing various phenotypic and genotypic personality characteristics. Since there were thirty patients, and since there were six possible sequences in which the four data groups could be arranged when one (the BDS) was routinely considered first, five clinicians were used. Each clinician studied six patients, one from each of the possible data sequences. Four Q-sorts were obtained from the clinician in each case and each sort was considered to reflect the total amount of data which were available to the clinician at the time of that sort, (with a specific informational increment over the previous condition). The thirteen therapists represented the three usual disciplines found in such settings. After ten hours of psychotherapy (in three cases, after eight) the therapist performed a (criterion) Q-sort of the 97 items describing the patient's personality make-up. The therapist did not have access to the psychological data used by the diagnostician. Product moment correlation coefficients were obtained between the relevant variables. A stereotyped personality description was also obtained and the average agreement between it and the thirty criterion sorts was considered the chance level of accuracy (validity).

The major conclusions were: 1) clinicians are able to describe psychiatric patients more accurately than does a stereotyped personality description, 2) there are differences among the kinds of data in terms of their contribution to accurate personality descriptions, 3) the diagnostic interview was most frequently associated with the highest validities and was of greatest value when performed early in the diagnostic process, 4) the Rorschach test was significantly associated with a decrease in validity, 5) detailed personality descriptions from MMPI profiles alone are of limited validity when obtained clinically and when compared with therapists' judgments as criteria, 6) clinicians differ in both their overall diagnostic skill and their success with the specific data types, and 7) the relationship between the amount of data available to clinicians and the accuracy of their diagnostic statements is complex.

The absolute level of agreement between diagnosticians and therapists was not high, and it was suggested that alternative methods of obtaining personality evaluations (psychodiagnoses), such as through an actuarial approach, should be further considered if higher levels of accuracy are desired. 243 pages. $3.15. Mic 57-3334

A PSYCHOLOGICAL STUDY OF THIRTY RESIDENTS OF A SMALL TOWN

(Publication No. 22,217)

William Henry Dalton Vernon, Ph.D.
Cornell University, 1957

This was a pilot study aimed at a better understanding of "normal" people. It is part of the Stirling County Project, a long term study devoted to investigating the relationship between sociocultural factors and psychiatric disorder. It is parallel to a psychiatric study. It investigated thirty residents of a small town who had already been evaluated by a panel of four psychiatrists. The sample consisted of ten persons who had been evaluated as almost certainly having symptoms of psychiatric significance, ten who were, or had been actual patients at a psychiatric clinic, and ten who had been evaluated as psychiatrically asymptomatic.

These thirty persons were given a battery of psychological tests including intelligence tests, tests of temperament of the structured factor scale type, and projective tests. Length of testing was about five hours per subject.

In order to deal with the test material statistically, Stephenson's Q-methodology was employed. An eighty item Q-deck was prepared covering the major areas of the personality sphere as represented in the tests.

To provide a criterion measure of "mental health," six professionally trained persons sorted the Q-deck under instructions to describe a person possessing ideal mental health. These sorts were factored. The first centroid factor accounted for all the variance, the residuals being almost non-existent. This factor was then expressed as a Q-sort which conceptualized a person with ideal mental health.

The tests of each subject were scored and interpreted blind, and a description of each subject made by sorting the Q-deck in terms of their test results. Sorting was done independently by two different psychologists as a measure of reliability. The median reliability coefficient was .68. Finally, the sorts of both psychologists for each case were averaged to produce the sorts to be used in analysis.

The sorts, including the criterion sort, were intercorrelated and factored. Five factors resulted representing "interactional person types." The first factor was rotated to the criterion and the others rotated to run through clusters. Very little rotation was necessary to relate the first factor to the criterion. The factors were translated into trait arrays and thumbnail portraits prepared from the trait arrays of each type. The first factor and one other were considered to represent asymptomatic types. There were few persons in the thirty with loadings on one factor alone, that is, there were few representatives of "pure types." In all, seventeen varieties of person type, pure and mixed, were represented.

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A comparison of the psychiatric and psychological assessments of the two groups showed that there was little disagreement about the patients and the symptomatic non-patients. However, there were some interesting contrasts, particularly with regard to "improved" patients.

There was most disagreement about the group considered to be asymptomatic by the psychiatrists. The data hinted at significant sociological reasons for this but the number of cases was too small for adequate assessment. It was felt that the contrasts were more significant than the agreements between the two methods and needed to be explored further.

The nature of the criterion was discussed and it was concluded that, though it represented some degree of reality and explanatory power, it was in great measure the expression of a subcultural stereotype.

The limitations of one type of data - in this case test data - for dealing with the problems of mental health was discussed, and it was suggested that the full use of all data, psychiatric, psychological, and sociological would be necessary, and a larger sample, both of Q-deck items and of persons, to really get hold of some significant understanding of healthy mental processes and organization.

154 pages. $2.05. Mic 57-3335

ON THE RELATIONSHIP OF MANIFEST ANXIETY TO LEARNING FROM COLORED AND NON-COLORED STIMULI

(Publication No. 21,321)

Thomas A. Wickes, Jr., Ph.D.
Purdue University, 1957

Major Professor: J. M. Hadley

This study was designed to investigate the relationship between anxiety level and learning performance. In general, it was predicted that although a moderate amount of anxiety might facilitate learning, the overall effect would be for those people with higher anxiety levels to exhibit poorer learning performance. As a parallel problem it was also intended to investigate the interaction between anxiety and the effects of presenting the to-be-learned material in color as contrasted to black-white form. Empirical clinical observations, theoretical explanations, and experimental studies concerning these two interrelated problems were reviewed. An analysis of this review indicated conflicting points of view and evidence.

The specific experimental design involved the use of parallel color and black-white films in presentation of the information to be learned. Tests were designed to measure the amount learned from these films. The films were administered to 93 graduate and undergraduate students in a counterbalanced order designed to rule out order effects, practice effects, and other group and interaction effects which might bias the results of the study.

As a measure of anxiety level, the Heineman Multiple Choice Inventory, a forced-choice form of the Taylor Anxiety Scale, was administered to all subjects.

Results of the study indicated that no significant relationship between anxiety level and learning from the films was observed when the combined scores of the males and females were analyzed. Similarly, when the total group was considered no significant interaction effect between anxiety level and color in films was observed.

Although this question was of secondary interest, no advantage for colored film over black-white film was observed in the present groups of subjects and with the film materials utilized. When the results were separately broken down for male and female subjects several interesting trends were noted. For example, the women did consistently better on the black-white film tests than on the color film tests, regardless of anxiety level. The men seemed to do somewhat better on the color film tests than on the black-white film tests and the higher the anxiety score earned by the individual man, the greater the discrepancy between his score on the black-white film test and the color film test. It appeared that, within the limitations of the present study, the learning performance of the two groups may have been affected differently by anxiety level and its interaction with the presence of color in the films.

Speculations were offered to explain the inconclusive findings and further research was suggested to explore and clarify the possible between and within sex differences suggested by the data.

87 pages. $2.00. Mic 57-3336

PSYCHOLOGY, EXPERIMENTAL

LATENCY AND MAGNITUDE OF THE GALVANIC SKIN RESPONSE AS RELATED TO LONG AND SHORT AUDITORY STIMULI

(Publication No. 22,314)

Arnold Elvin Aronson, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor John V. Irwin

Statement of the Problem

An important problem in galvanic skin response (GSR) audiometry is the occurrence of numerous spontaneous GSR's that can be easily mistaken for GSR's to tone. Currently, audiologists accept only GSR's with latencies of approximately 1 to 3.5 seconds as valid responses, since GSR's falling outside of this range are likely to be spontaneous. Nevertheless, there is no guarantee that GSR's that occur within this range are valid.

In this study, the latency and height characteristics of the GSR to tones at threshold and above threshold intensities were investigated in order to provide additional information to facilitate identification of the GSR to tones. Previous research indicates that larger GSR heights can be obtained if conditioning is carried out using a 0.6 second (short) tone followed instantaneously by shock as opposed to using a 3.0 second (long) tone followed instantaneously by shock.

Procedure

Forty subjects were divided into two groups of 20 each. Voluntary thresholds for a 1000 cps tone were taken on the right ear only. Twenty subjects received conditioning and

GSR threshold with a 0.6 second tone: the remaining 20 subjects underwent the same procedure except that a 3.0 second tone was used. Partial (40%) reinforcement with shock was maintained. The GSR threshold test utilized a 1000 cps tone and was designed to yield 5 scorable responses at + 10 db, + 5 db, 0 db, - 5 db, and - 10 db re voluntary threshold. Zinc disc electrodes with Bentonite clay in zinc sulfate were attached to the palm and dorsum of each hand; conductance changes were recorded from one hand and potential changes from the other. These changes were presented on a cathode ray oscilloscope and photographed. Condenser-coupled amplifiers with a low frequency time constant of one second allowed only changes that occurred over a time duration of one second or less to be recorded, while slower changes were attenuated. GSR's were measured for latency and height. Measures of GSR height were then converted into conductance units.

Results and Conclusions

1. The 0.6 second (short) tone method elicited significantly larger GSR's at threshold intensities and above than the 3.0 second (long) tone method.

2. For both long and short tone groups, mean GSR magnitudes increased significantly with tonal intensity. However, the differences between GSR magnitudes at threshold intensities and above were greater for the short than the long tone method. With the knowledge that GSR magnitude is directly related to tonal intensity, the examiner may narrow his magnitude criterion for accepting a GSR as a valid response.

3. Mean GSR latencies became significantly shorter with increased tonal intensity for both tone duration groups. Variability of GSR latencies at threshold intensities and above was less for the short than the long tone group. With this knowledge, the examiner may narrow his latency criterion for accepting a GSR as a valid response.

4. The short tone method was superior to the long tone method on the basis of ease of conditioning, since a greater percentage of subjects conditioned successfully under this method than the long tone method.

209 pages. $2.75. Mic 57-3337

THE RELATION BETWEEN JUDGED SIMILARITY AND THE PHYSICAL PROPERTIES OF PLANE FIGURES

(Publication No. 22,330)

Davis Jordan Chambliss, Ph.D.
The University of Wisconsin, 1957

Supervisor: Assistant Professor L. Benjamin Wyckoff

The purpose of this study was to relate the scaled judgments of similarity made on nonsense polygons to the physical properties of the stimulus figures.

This study employed two groups of straight-line polygons, 57 pairs with five and ten sides, respectively. These were a random sample from a defined population. Subjects were required to rate these stimulus pairs for similarity on a seven-point scale. Two scale values were computed: a new procedure devised for this study and Attneave's Method of Graded Dichotomies. There were four experiments in all: (I) an original experiment with simultaneous presentation of both members of each pair for 10 seconds, (II) a replicate of (I), (III) successive presentation of each member of each pair for 5 seconds with a 5 second interval between, and (IV) simultaneous presentation for 10 seconds with the left member of each pair rotated clockwise through 90°. An extensive series of measures were taken upon the figures, and a number of transformations were employed to achieve approximate linearity. Intercorrelations were derived for the measures and the eight scale values.

The results were as follows: (1) The procedures for the latter two experiments were more difficult for the subjects and the correlations were lower, often significantly. The overall form of the distributions was the same, however. (2) The evidence favored the use of the new Attneave scale over Graded Dichotomies, but the scales were highly enough correlated to render this advantage slight. (3) A factor analysis of the two intercorrelation matrices showed that, for both groups of figures, the extraction of a single factor left the residuals insignificant. This was taken as evidence of a single dimension of psychological similarity along which the differences between the pairs fell. (4) The measures were carefully studied, and it was concluded that area and all measures upon the side lengths were of relatively little value, but that measures upon the angles and vertices of the figures could account for most of the variance of the judgments. (5) The measures for the five-sided group were consistently, and often significantly, lower than those for the ten-sided group, when correlations with the scale values were compared, but the forms of the two distributions were not different.

Extensions of this work to other types of figures and to animal discrimination problems were suggested. Mention was made of a projected learning experiment with these same figures for human subjects.

69 pages. $2.00. Mic 57-3338

THE EFFECT OF REDUCED EXPOSURE DURATION ON SIMULTANEOUS BRIGHTNESS CONTRAST

(Publication No. 22,331)

Peter John Chinetti, Jr., Ph.D.
The University of Wisconsin, 1957

Supervisor: Assistant Professor H. Leibowitz

The effect of variations in luminance of an inducing-field on test-field brightness was studied for a 30' visual angle square test-field directly above which was a square inducing-field of the same size. The method of binocular matching was used. The inducing-and test-field were presented to the left eye and comparison-field of the same size and shape as the test-field to the right eye. For a given luminance of the test-field, the subject adjusted the luminance of the comparison-field to match the test-field by varying the luminance of the comparison-field. At the various levels of inducing-field luminance which were used, changes in the brightness of the test-field were reflected in changes of the comparison-field settings made by the subjects.

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Simultaneous brightness contrast was studied for two exposure durations of the test- and inducing field. In Experiment I, contrast was studied with steady exposure of the stimulus fields. In Experiment II, contrast was studied with short exposure duration of the test- and inducing field. The subject controlled the exposure of the two fields with a hand button-switch and was able to discharge the gas tube (Kemlite, type 5W, .0002 sec. duration) as often as once every 5 sec. In Experiment I the variation in test-field brightness was determined for seven values of inducing-field luminance (3.30 to -0.93 log mL and 10g - oo). Three values of test-field luminance were used (2.23, 1.18 and 0.18 log mL). In Experiment II change in brightness of the test-field was determined for eight values of inducing field luminance (0.0 to -4.85 log relative luminance and log - oo, where unit luminance, 0.0, was ten times the luminance of the test-field which matched a 2.57 log mL comparison-field). Three values of test-field luminance were used. These values were obtained by having the subjects match the brightness of the test-field flash luminance with the comparison-field of steady exposure duration in the absence of the inducing-field. The average comparison-field matches of the test-field luminances were 2.57, 1.66, and -0.14 log mL.

When inducing-field luminance is equal to or less than test-field luminance the inducing-field has no effect on the brightness of the test-field. No evidence was obtained for a "brightness enhancement" effect for inducing-field luminances less than test-field luminance. For inducing-field luminances greater than test-field luminance the brightness of the test-field decreased linearly with increase in inducing-field luminance. These findings were obtained for both steady and reduced exposure duration. It was further found that short exposure duration increased the contrast effect of an inducing-field on a test-field as compared to the effect obtained for steady exposure duration. This was shown by a comparison of the slopes of the contrast functions for short and steady duration at values of inducing-field luminances greater than test-field luminance.

The findings in this study and the results from other similar experiments are discussed with respect to Hartline's neurophysiological studies and Fry's stray-light explanation of the findings in experiments on simultaneous brightness contrast. It is pointed out that the results of these studies are predicted by the neurophysiological findings of Hartline which suggest that the contrast effect is due to a retinal inhibitory or integrative process. It is further shown that the stray-light phenomenon is a useful concept for explaining how an inducing-field can be effective for large separations of test- and inducing field. But it is emphasized that stray-light functions merely to initiate an inhibitory process in the vicinity of the test-field and that the contrast effect is still produced by an inhibitory mechanism. 48 pages. $2.00. Mic 57-3339

THE EFFECT OF ELECTRO-CONVULSIVE SHOCK ON A PUNISHMENT DISCRIMINATION AND ON AN EXTINGUISHED PUNISHMENT DISCRIMINATION

(Publication No. 21,961)

Irving Geller, Ph.D.
The American University, 1957

The present research was concerned with the effects of electro-convulsive shock on a conditioned punishment discrimination (Experiment I) and on an extinguished punishment discrimination (Experiment II) in the white rat. In Experiment I the punishment discrimination was established as follows: thirsty animals learned a lever-pressing response for a periodic water reward. While these animals were engaged in lever pressing a warning stimulus (tone) was introduced into the experimental situation, in the presence of which any lever response produced a shock to the feet of the animals.

A series of such conditioning trials resulted in complete suppression of lever responding in the presence of the warning stimulus. Animals were then divided into an experimental and a control group. The experimental animals were subjected to 21 ECS treatments distributed over a seven day period. When tested for retention of the punishment discrimination by non-shock reinforced tone presentations, it was found that the suppressed response had been attenuated in the experimental group. Rats which had received the shock therapy now lever responded in the presence of the warning stimulus whereas the control animals retained the punishment discrimination.

In Experiment II the punishment discrimination was established in an essentially similar manner. When fully established in all animals, the punishment discrimination was extinguished by a series of non-shock reinforced presentations of the auditory stimulus. After the animals were divided into an experimental and a control group, the experimentals were subjected to 21 ECS treatments distributed over a seven day period. When tested for recovery of this extinguished punishment discrimination both experimental and control animals showed absolutely no recovery.

A discussion of these results involved a comparison with the findings of previous research. Several interpretations were offered to account for the data. Reference was made to the Pavlovian concept of extinction as an active "inhibitory" process as well as to the dubious value of attempting to explain such a phenomenon in terms of a formulation which lacks a clear behavioral reference.

Conclusions:

1. ECS does bring about recovery of lever responding which has been inhibited by punishment.
2. ECS therapy does not reinstate or bring about recovery of a previously extinguished punishment discrimination. 75 pages. $2.00. Mic 57-3340

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THE CONTROL OF DISCRIMINATIVE BEHAVIOR BY STIMULATION OF IPSILATERAL SITES IN THE STRIATE CORTEX

(Publication No. 22,309)

George Samuel Grosser, Ph.D.
Boston University Graduate School, 1957

Major Professor: Professor John M. Harrison

The present research stemmed from (a) Mayer's finding that there is no generalization between contralateral sites in the visual cortex of the albino rat (when the sites were stimulated by way of implanted electrodes, one being used as a conditioned stimulus, the other as a test stimulus in order to measure the extent of generalization); (b) anatomical data on the visual cortex, e. g., Nauta and Bucher's finding of rich inter-connections among the cells of the visual cortex of the same side (in the rat), and similar findings by Sholl with regard to the cat; and (c) the work of Myers, who found (with cats) that inter-ocular transfer always appears unless both the posterior corpus callosum and the decussating fibers of the optic chiasm are cut.

If (1) generalization between the activity of different parts of the brain depend on intact neural inter-connections between these areas (as suggested by Myers' research) and (2) cells in the ipsilateral visual cortex of rats are richly inter-connected (as Nauta and Bucher report), then one should expect substantial generalization from one site in the visual cortex to another on the same side.

For the present experiment, a pair of electrodes implanted in the visual cortex of one side were used. Albino rats were the subjects.

For the four rats providing data on the problem as stated, the placement of each electrode was verified by histological methods to be in area 17.

The behavior was pressing the bar in a Skinner box. The schedule was a momentary discrimination, with a bar-press in the presence of S^D serving (a) to produce a food-pellet reinforcement and (b) to remove the S^D. Each animal's daily food ration was controlled by weight so that the rat was run at 80% of his ad lib body weight.

In the main experiment, S^D was stimulation by way of one electrode and S^Δ was the absence of this stimulation. Data were taken separately for two periods -- a 40-min. "warm-up" period followed by a "preferred hour." Criterion behavior was considered to be the production of 100 or less S^Δ responses and about 50 S^D responses during the preferred hour. Each S^D trial was limited to 10 sec. duration. After reaching criterion, each animal was tested for generalization of the behavior from the trained (S^D) elec trode to the test (S^T) electrode. Sixteen trials on each of these two stimuli were intermingled during the critical test session.

When a current of 0.30 mA. (adequate for training the S^D electrode to criterion) was used, there was no response at all in any of the 16 trials with the S^T electrode.

Various controls were employed to rule out alternative interpretations of the data to the one reported by us. (1) Before the electrodes were implanted, each animal was trained with light as S^D, dark as S^Δ, and then tested with a dim light as S^T. This was done to show that the animals, training methods, and apparatus were capable of yielding generalization-type data under the appropriate conditions, as specified by the experimental literature. (2) The S^T electrode, after the inter-electrode generalization test, was trained as an S^D. This was successful in all four cases reported. (3) The momentary discrimination schedule removed the cortical S^D. Could this event reinforce the bar-pressing independent of food? To answer this, the animals were subjected to experimental extinction -- a bar-press during an S^D trial served only to remove the S^D. Under these conditions behavior was extinguished to a criterion of 15 consecutive S^D trials with no response to the S^D. Other controls were run, and other data collected. The intensity of the cortical stimulation may prove to be a parameter of the extent of inter-electrode generalization.

The conclusion was drawn that stimulation of a site in the visual cortex sufficient for service as a conditioned stimulus is nevertheless not sufficient for stimulus generalization to a test site in the visual cortex of the same side.

156 pages. $2.05. Mic 57-3341

SEMANTIC GENERALIZATION AS RELATED TO WORD ASSOCIATION

(Publication No. 22,470)

Walter David Mink, Ph.D.
University of Minnesota, 1957

Adviser: Wallace A. Russell

The transfer or generalization of a learned response from one situation to a different situation provides provocative problems in psychological theory. The purpose of this research was to investigate certain aspects of the role of language in generalization.

Most of the studies in semantic generalization to date have used classical conditioning techniques in which an involuntary response in conditioned to a word and generalization is measured to another word which is related to the original word in a logical or grammatical way. The present study departs from the earlier procedures in two ways. First, a voluntary response was used. Second, the relationship between the words is one of associative habit strength as measured by word-association response frequencies.

Subjects were taught to press a lever to each word of a list of words. Then a second list was presented which contained the original words, associates occurring with known frequency to the original words, and unassociated control words. The subjects were instructed to press the lever only to the words which were recognized from the original list. Generalization was considered to have occurred if the number of responses to the associated words was significantly greater than to control words.

After an initial study which posed some questions with regard to the general design of the experiments, three further experiments were performed. All three yielded significant amounts of generalization. Several variations of method were tried with no significant differences occurring as a result of the variations. As it turned out, the three experiments gave very conclusive evidence of the occurrence of generalization using this technique since they served as repeated confirmations of the general technique.

A second series of four experiments was performed which was designed to investigate the functional relationships between certain characteristics of the words and the amount of generalization. The results of these experiments indicated that the direction and the frequency of the association were important factors. Generalization effects were most marked when the stimulus word of an associated pair was used in the learning list and generalization was measured to its response. When the response word of the pair was used on the learning list and generalization was measured to the stimulus word the amount of generalization was not significant. Considering the generalization as occurring from the stimulus member of an associated word pair to its response, it was discovered that the amount of generalization was related to the strength of association of the words as estimated from the frequency with which the response is given to its stimulus word in word association norms.

The results were discussed in terms of two possible explanatory factors. One suggested that during the learning phase, the lever pressing response tended to become associated with the associates of the words to which it was being learned. The other was concerned with the opportunities provided for contrast and discrimination during the test for generalization by the different list occurrences of the words. Both of these alternatives were offered tentatively, but gained some support from a secondary analysis of the results. Hypotheses generated by these analyses are capable of experimental test and are offered as suggestions for further research in semantic generalization.

100 pages. $2.00. Mic 57-3342

EXTRA-FOVEAL DISCRIMINATION CHANGES AS A FUNCTION OF BINOCULAR EXPOSURE TRAINING

(Publication No. 22,298)

Frank Robert Shoaf, Ph.D.
Purdue University, 1957

Major Professor: Kenneth M. Michels

The research is an investigation into the basic postulates of Hebb's theory of perception. Studies in support of Hebb, particularly those concerned with interocular transfer of monocularly learned tasks and those of extra-foveal discrimination changes as a function of experience, are reviewed.

This thesis reports an attempt to extend the reviewed research to determine 1) if extra-foveal areas of the retina can be selectively trained to discriminate single test objects, and 2) what relationship exists between intra-ocular transfer of this training and past reading experience.

Eight male college students served as subjects in this research. One group of four subjects was binocularly trained to discriminate single capital letters which were tachistoscopically presented 7.2 degrees visual angle on the right of the point of visual fixation. The second experimental group was binocularly trained with the same test objects to the left of fixation. One-hundred stimulus presentations were given at each of twenty-five training sessions for each subject. The subjects each attended one training session every forty-eight hours.

At the end of training three post-training sessions were conducted over a sixty-day period, in order to determine the permanence of the training effects. Measurements were also taken in the retinal areas contralateral to that trained for each subject, to determine if intra-ocular transfer were evident.

It was found that upon initial stimulation there was no difference in discriminability of letters whether presented in the right or the left visual areas. With continued training, both groups showed significant improvement of the ability to discriminate most letters. However, the group trained with presentations in the right visual field became superior in performance to those trained on the left of fixation. Among those stimulus objects which were equally well discriminated by both groups, the symmetrical letters were predominent.

A test for intra-ocular transfer of the ability to discriminate was made by determining the performance of each group for presentations in the visual field contralateral to the trained side. Both groups demonstrated transfer of training, but that from the left to the right visual field is relatively greater than the partial transfer of this function from the right to the left.

The results of this study are compared to those of Miskin, Forgays, and Orbach in which whole words were used as stimulus test objects and to the interocular transfer studies of Riesen, Siegel, Chow and Nissen performed with animals. The significance of these findings are reviewed in light of Hebb's theory as it applies to perception.

72 pages. $2.00. Mic 57-3343

A STUDY OF EXPRESSIVE GRAPHIC MOTOR MOVEMENTS AND THEIR RELATIONSHIP TO TEMPERAMENT FACTORS

(Publication No. 22,002)

Max Talmadge, Ph.D.
University of Utah, 1957

Chairman: M. Duane Bown

A number of studies in the area of expressive movements have indicated that this is a meaningful avenue of exploration and have found positive results in revealing the intra-consistency of human functioning both in the movement aspect and other characteristics of human behavior. However, previous studies have not adequately handled the three major interrelated aspects of the problem of expressive movement--the reliability of expression, the extent of unity or generality in expressive movement, and the relationship of expressive movement measures to other behavior characteristics.

The present investigation deals only with graphic-motor expression attempting to test the three interrelated aspects by objective means. Four major hypotheses were formulated:

1. Graphic-motor movements are stable measures, and test-retest correlations will reveal a high degree of reliability.

2. Individuals are internally consistent in their graphic-motor movements. Similar types of movement will be highly correlated.
3. Certain types of graphic-motor movements go together and meaningful clusters will be found among the movements and with temperament factors.
4. Certain specific relationships between graphic-motor movements and temperament factors were hypothesized.

Eighty male college students were administered a modification of the Mira Myokinetic Technique in which graphic movements are reproduced while the subject's vision is screened. Ten separate tasks were given and many of them contained similar variables such as tempo, pressure, and length measurements. The Thurstone Temperament Schedule was also administered in order to obtain a measure of temperament differences.

The approach throughout was a correlational one and 1,891 correlations were obtained. The first hypothesis was confirmed by a test-retest reliability coefficient of .62. The second hypothesis was largely confirmed, although all the results were not equally significant. The findings indicate that individuals are consistent in a number of important variables such as personal tempo, amount of pressure applied, and length of graphic reproductions.

The third hypothesis, that of generality, was also partially confirmed. Meaningful consistent significant correlations were obtained among the different movement variables. The nature of the relationships only became evident after the data were analyzed. For example, long length was found consistently to be significantly related to greater distance between lines. A cluster analysis was performed to determine if specific groupings could be found. Five clusters were revealed. The first cluster was called "tendency to perseverate" and contained such variables as length in a task when shifting direction is required and the Reflective factor. The second cluster was called "rightward and upward shifting" and contained variables in which directional movement is made where none is required. The third cluster was called "tempo" and contained mainly time variables plus the Active, Vigorous, and Stable factors. The fourth cluster was called "emphasis" and contained such measurements as pressure, fewness of lines and angles. The fifth cluster contained the Impulsive, Dominant and Sociable temperament variables and was called "outgoingness."

The fourth hypothesis was tested by examining relationships between the temperament factors and some of the movement variables. Although few of the individual hypothesized relationships were significant, positive correlations in the predicted direction were usually obtained. The Activity factor had greater than chance correlations with the time and pressure scores. The Vigorous factor had positive relationships with pressure, fewness of lines, and tempo. The Impulsive factor was negatively related to length scores where shifting was required, and had positive relationships with tempo and pressure scores. The Dominant factor related positively with the pressure variables, fewness of angles and fewness of parallel lines. The Stable factor had significant positive correlations with most of the time variables. The number of angles and lines in reaching a certain distance also had significant relations with this factor. The Sociable factor had positive correlations with upward and rightward shifting variables. The Reflective factor had negative correlations with the time variables and positive correlations with the length variables when shifting was required.

Multiple correlations were computed between the predictor variables and the temperament factors. Significant correlations were obtained in all cases indicating that there may well be a fundamental relationship between a combination of movement variables and the temperament factors. Wherry-Doolittle multiple correlations were computed in order to determine the variables most useful in predicting the temperament factors. All the correlations were significant, ranging from .33 to .65. The interpretation of these results in the order in which the graphic-motor variables were obtained by this procedure are as follows:

1. The Active person has a fast natural rate of speed, shifts downward, and exerts heavy pressure.
2. The Vigorous person shifts leftward, requires fewer lines in reaching a certain point, exerts heavy pressure, and has a fast tempo.
3. The Impulsive person has short length where shifting is required, fast tempo, and exerts heavy pressure.
4. The Dominant person requires fewer angles in reaching a distance, shifts upward, and exerts heavy pressure.
5. The Stable person requires fewer lines in reaching a distance, exerts light pressure, has greater distance apart between lines drawn with right and left hand in upward direction, requires fewer angles in reaching a distance, and has a fast tempo.
6. The Sociable person shifts faster, has less distance apart between lines drawn with right and left hand in a downward direction, and shifts upward and rightward.
7. The Reflective person is unable to shift rapidly, has slow tempo, requires more lines in reaching a distance, and has greater distance apart between lines drawn with right and left hand in downward direction.

It was concluded that the present results seem quite promising in revealing the basic unity of an individual's graphic-motor movements and indicate that this area is a fruitful one for further investigation and may be utilized profitably in establishing objective measures of temperament. 206 pages. $2.70. Mic 57-3344

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

ELISHA: A PROBLEM IN LEGEND AND HISTORY

(Publication No. 21,591)

Ernest Sunley Frerichs, Ph.D.
Boston University Graduate School, 1957

Major Professor: Professor Elmer A. Leslie

Statement of the Problem. The dissertation is an investigation of the mixture of legend and history in the Elisha cycle in II Kings, attempting to discover to what extent the interests and life of the historic Elisha can be authenticated. The Elisha cycle is used as the basis for exploring the functions of legend and history in Biblical traditions. A secondary problem is an evaluation of the relationship between Elijah and Elisha, especially at those points where it is frequently asserted that Elisha traditions are adaptations of Elijah traditions.

Procedure. The materials of the Elisha cycle are examined with respect to their present nature and possible origins through the use of form- and literary-critical methods. These traditions are grouped according to the roles which the early preservers of the Elisha materials appear to have assigned to the prophet. Three such roles are considered: 1) wonder worker; 2) cultic prophet; 3) political prophet. Elijah and Elisha traditions are compared at those points at which the prophets are associated either historically or through doublets in the traditions. Talmudic and patristic writings are examined to compare the emphases of Elisha's ministry in Kings with the aspects of Elisha's ministry which appealed to later Jewish and Christian writers.

Conclusions. 1. The three roles considered prove to be the most adequate bases for comprehending the varying traditions of the Elisha cycle.

2. The role of wonder worker is derived from Elisha's role as cultic prophet. The assumption that Elisha can work wonders is based on an acceptance of him as cultic prophet and as a leader of the "sons of the prophets."

3. The roles of Elisha within the tradition are best explained if it is assumed that these materials were preserved by prophetic circles, especially the "sons of the prophets."

4. The preservation of the Elisha tradition by the "sons of the prophets" resulted in an emphasis upon prophetic roles for Elisha which would cease to be characteristic of classical prophecy after Amos.

5. Elisha's stature as a prophet was not enhanced by his historic and literary relationship to Elijah. The frequently asserted superiority of Elijah as a prophet is shown to result from judgments based both on the greater excellence of the literary traditions of Elijah and on his greater importance for Judaism. An examination of Elijah's importance in Judaism shows clearly that it rests on factors other than the quality of his historic ministry.

6. In four instances of parallelism between Elijah and Elisha traditions only one instance (I Kings 17:17-24 parallel to II Kings 4:8-37) demonstrates clearly a transfer from Elijah to Elisha traditions.

7. The legendary aspects of those traditions which picture Elisha as political prophet are not to be discounted since Elisha's participation in the political life of the nation is conceivable for the period in question. It is shown that the settings for the political traditions in the Elisha cycle are all authentic for the general period, even though specific dates cannot be attached to all such traditions.

8. The legendary aspects of the Elisha traditions are shown to serve an historical purpose in communicating the interests and needs of those among whom these traditions were preserved. The legends are important in expanding our understanding of group prophecy in Israel in the ninth century B.C. although they do not carry us to the historic Elisha.

212 pages. $2.75. Mic 57-3345

A REDEFINITION OF THE PSYCHOLOGY OF RELIGION: WITH SPECIAL REFERENCE TO CERTAIN PSYCHOLOGICAL THEORIES OF GORDON W. ALLPORT

(Publication No. 21,559)

Orlo Strunk, Jr., Ph.D.
Boston University Graduate School, 1957

Major Professor: Dr. John D. Copp

The purpose of this dissertation is (1) to offer a redefinition of the psychology of religion in light of its historic and contemporary status; (2) to discover the flaccid aspects traditionally present in the psychology of religion and invigorate these aspects with contemporary psychological theories, especially certain theories emphasized by Gordon W. Allport; and (3) to present various illustrative hypotheses to be tested in view of the understanding of what is meant by the psychology of religion as developed in this study, thus indicating special factors to be considered in designing future research in the psychology of religion.

Method and Procedure

A relatively complete survey of the historic status of the psychology of religion is made. A descriptive survey of the psychology of religion literature between the years 1950 and 1955 is then presented, including a partial content analysis of 205 different works. A critique and a definition of the psychology of religion are offered in light of the historic and contemporary aspects of the field. With the

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

definition stated, it is shown how certain of Gordon W. Allport's psychological theories and emphases may contribute to the future of the psychological understanding of religious phenomena. Sample hypotheses are stated in light of the newly formulated definition.

Findings and Conclusions

The historic survey of the psychology of religion reveals that men such as Wundt and Galton laid the scientific groundwork for the development of a psychological approach to religious phenomena. The pioneers for the most part retained a scientific spirit. Soon, however, theologically-oriented and psychoanalytically-oriented workers entered the field and less empirical methods were used by both groups. With the proliferation of behaviorism in psychology proper, the psychological study of religion was relegated to two groups, the theologically-centered and the medically-centered. The impact of practical considerations led to the development of pastoral psychology, a pragmatic and global type discipline which soon occupied the attention of the psychologist-theologian. Psychoanalysis, on the other hand, studied religion purely in terms of its own metapsychological system.

A contemporary survey of the psychology of religion reveals that the psychology of religion as initially understood is practically non-existent. Most present-day studies are psychoanalytically-oriented or psychiatrically-oriented, placing explanations of religious behavior in a strict framework of geneticism and unconscious motivation. Another large segment of the contemporary literature deals with pastoral psychology. There is an obvious ambiguity between what is the psychology of religion and what is pastoral psychology.

Contemporary criticism of a great deal of modern psychology proper comes from several sources, including the phenomenological approach, the cognitive emphasis, the field theory propensity, and the personalistic trend.

In light of these current criticisms and in view of the historic and contemporary status of the psychology of religion, the following conclusions are offered:

1. That a clear distinction be maintained between the psychology of religion and pastoral psychology and between the psychology of religion and psychiatry and/or psychoanalysis.
2. That the psychology of religion be defined as that branch of general psychology which attempts to understand, control and predict human behavior, both propriate and peripheral, which is perceived as being religious by the individual, and which is susceptible to one or more of the methods of psychological science.
3. That in light of the contemporary weaknesses in the psychology of religion, certain of Gordon W. Allport's theories be considered in research design and in conceptual formulations, especially his emphasis on methodological plurality and idographic propensity. It is also suggested that Allport's concepts of functional autonomy, value schemata, propriate states and processes, and mature religious sentiment be considered in any future attempts at understanding religious behavior.
4. That research in the psychology of religion be problem-centered, rather than method-centered or system-centered, thus leaving research problems to be formulated through the ingenuity of individual workers.
5. That researchers take developmental factors into consideration in formulating hypotheses, but that at present the psychologist of religion concentrate especially on the development and description of a criterion of religious maturity. 171 pages. $2.25. Mic 57-3346

THE VIEWS OF CHARLES HAROLD DODD CONCERNING THE NEW TESTAMENT

(Publication No. 21,876)

Duane Allison Walker, Th.D.
Boston University School of Theology, 1957

Major Professor: Dr. Donald T. Rowlingson

The purpose of this dissertation is to analyze the thought of Charles Harold Dodd as it relates to the New Testament field. It seeks to determine whether the study of four decades devoted to the New Testament has produced from his pen an amorphous collection of unrelated studies or an organic whole built upon an underlying unity and issuing in a schema. The end in view is not a critique of its content, nor an assessment of its value, but the presentation of a point of view and synthesis of thought. The raison d'etre for the investigation is the influence of Dodd's thought upon contemporary theological debate, the timeliness of the subjects upon which he has written, and the fact that his writings have not heretofore been analyzed as a whole.

The method of procedure in the writing of the dissertation is a study of all of Dodd's theological writings. The treatment of the material is arranged in a fourfold classification: (1) Dodd's presuppositions and interpretative approach; (2) Detailed examination of Dodd's writings; (3) The resultant New Testament schema; and (4) The summary, conjoined with observations on Dodd's major areas of contribution and vulnerability as judged by present-day New Testament thought.

Dodd approaches the Bible as a unity of diverse writings which together are set forth by the Church as a revelation of God in history. His interpretative approach advocates the mutual compatibility of the historical and the theological method. What the biblical writers thought is no less important than what took place. The first task of criticism is to explain the material as it now exists. The goal of New Testament study is to bring unity out of diverity. Interpretation must be the conscious and direct aim of biblical study. This is to be effected through a historico-critical approach which advances to a synthesis of theological interpretation.

The examination of Dodd's writings lends itself to analysis within the following general pattern: (1) The Background of the New Testament, (2) The Criticism of the New Testament, (3) The Life of Jesus, (4) Pauline Studies, (5) Johannine Studies, and (6) The Apostolic Age. The fundamental and regulative ideas of Dodd's thought, as derived from the examination of his writings, amounting to a schematic framework, are:

(1) Éschaton and History: The Sitz im Leben. The unduplicable historical event--the advent of the éschaton into the historical process--is God's supreme and ultimate disclosure of Himself. "The Word became flesh." This is God's final utterance. Heilsgeschichte reaches its appointed

dénouement--"the time is fulfilled." The horizontal interpretation of secular history is cut vertically by the word of God from outside history. Thus the pattern of history is exhibited in crisis rather than evolution, by which is meant not development in time, but judgment and a new order in which the purpose of God is brought to fulfillment. The Reign of God is a present fact. It is realized eschatology.

(2) Apostolic Proclamation: A series of items preached --or a kérygma. The affirmations constitutive of God's Reign in Jesus are proclaimed to a non-Christian public. This is the announcement or, more properly, the heralding, of the "saving facts."

(3) Apostolic Pedagogy: A series of ethical emphases taught--a catechésis or didaché. The implications of the "saving facts" are taught, to the individual as also to the community, as the Reign of God is embraced and establishes its sovereign rule. The didaché presupposes and explicates the kérygma.

(4) Apostolic Foundation: A series of Old Testament passages--or testimonia. The kérygma and didaché did not arise in vacuo. They are grounded in the whole redemptive process (Heilsgeschichte), for they have their foundation in the Old Testament.

(5) Apostolic Worship: A liturgical tradition. The "saving facts" are continually recapitualted in the observance of the Eucharist. It is a re-living of the decisive moment at which Jesus came.

The areas of New Testament study in which present-day scholarly opinion has recognized Dodd's most influential emphases are:

(1) Parabolic Studies, (2) Eschatological Studies, (3) Kerygmatic Studies, (4) The Epistle to the Romans, and (5) The Fourth Gospel.

The areas of New Testament study in which contemporary biblical thought regards Dodd as most vulnerable are:

(1) His interpretative method: historical-theological versus historical, (2) His emphasis upon the unity of the New Testament as versus its diversity, and (3) His emphasis upon eschatology as versus teleology.

321 pages. $4.15. Mic 57-3347

SOCIAL PSYCHOLOGY

THE CUMULATIVE DIFFERENTIAL EFFECTS OF REWARD AND PUNISHMENT ON THE PERFORMANCE OF SCHIZOPHRENIC AND NORMAL SUBJECTS

(Publication No. 21,587)

Ruth B. Aisenberg, Ph.D.
Boston University Graduate School, 1957

Major Professor: Dr. L. J. Reyna

According to Jenkins' theory, schizophrenia is occasioned by frustration which exceeds the individual's tolerance. Once initiated, the schizophrenic's maladaptive behavior results in further frustration which leads to even more maladaptive behavior and is thus responsible for the regressive process of schizophrenic disorganization. Jenkins states that the process is reversible: Reward can bring about a recession of the symptoms.

The results of existing studies of the effects of reward and punishment on schizophrenic behavior are conflictual. The present experiment is an attempt to test Jenkins' theory as it applies to this problem.

Three hypotheses were derived from the theory: (1) Schizophrenic behavior is to some extent the result of frustration. (2) That which increases frustration will increase schizophrenics' maladaptive behavior. Punishment increases frustration. The effects of this are cumulative and carry over to situations which are not objectively "punishing." (3) That which decreases frustration will decrease schizophrenics' maladaptive behavior. The effects of this are cumulative and carry over to situations which are not objectively "rewarding."

Twenty hospitalized schizophrenics, subdivided into Reward and Punishment groups, and twenty aides, similarly subdivided, were used in the study. Subjects were given a modified form of the Wisconsin Card Sorting Test, which requires concept-formation. When subjects in the Reward group gave a correct response, a sign reading "RIGHT" was illuminated. When they were incorrect, nothing happened. When subjects in the Punishment group gave an incorrect response, a sign reading "WRONG" was illuminated. When they were correct, nothing happened. After five consecutively correct responses, this training series was terminated. Subjects were then required to learn a new concept. The procedure changed in that the "RIGHT" sign was illuminated for correct, and the "WRONG" sign for incorrect, responses for both the Reward and Punishment groups. When the criterion of learning was reached, the test series was terminated.

Results were generally positive. The first prediction stated that the Schizophrenic Reward group, compared with the Punishment group, would take fewer trials to reach the criterion, make fewer errors, and have a shorter median response time in the training series. Statistical analysis indicated that the prediction was supported with respect to number of trials to criterion. Differences in number of errors and median response time were not significant.

The second prediction stated that the Schizophrenic Reward group, compared with the Punishment group, would take fewer trials to reach the criterion, make fewer errors, have a shorter median response time and give fewer perseverative responses in the test series. Statistical analysis indicated that the prediction was supported with respect to number of trials and errors to criterion. Differences in median response time and number of persever tive responses were not significant.

Prediction three stated that for control subjects trials to criterion, errors made, median response time and perseverative responses would not be significantly different in the Reward and Punishment groups. Statistical analyses indicated that the prediction was supported in all but two

cases: The performance of the Control Punishment group was superior to that of the Reward group. Thus, punishment exerted opposite effects on the performance of the normals and schizophrenics.

Comparison of the poorer control group with the better schizophrenic group indicated that the control group's performance was consistently superior throughout the training series. There was no significant difference between the two groups in number of trials and errors during the test series.

It was concluded that Jenkins' hypotheses are tenable. It appears that punishment increases and reward decreases schizophrenics' maladaptive behavior; and that these effects carry over into situations which are objectively "neutral."

Implications for further research were discussed.

118 pages. $2.00. Mic 57-3348

SMALL GROUP DECISION-MAKING AS A FUNCTION OF THE DISTRIBUTION AND DISCREPANCY OF PROBLEM-RELEVANT INFORMATION

(Publication No. 22,372)

Vera Tihanovna Kanareff, Ph.D.
The University of Wisconsin, 1957

Supervisor: Associate Professor J. C. Gilchrist

The pattern of distribution of, and the extent of the discrepancy within the problem-relevant information are the principal variables in this study of the decision-making process. Given a set of previously scaled information items, the information may be distributed so that one member receives all the items from a small subset of similarly-valued items, while the three remaining members share the information from a large subset containing similarly-valued items which differ in value from those in the small subset (LONE Distribution). It may also be distributed so that all four members share items from both subsets (ALL Distribution). These two methods of distributing the available information form the two levels of the Distribution variable. The distance between the scale value of the two subsets of information is varied to give four levels of the Distance variable. The Direction variable is determined by the values of the behavior items in the large subset as compared with those in the small subset. When the large set contains low-valued items and the small subset, higher-valued items, the direction is referred to as the LO to HI Direction; when the large set contains high-valued items and the small subset, lower-valued items, it is referred to as the HI to LO Direction.

The Ss are asked to dispose of a patient who may or may not be mentally ill. The decision is to be based on behavioral observations taken on the patient. These observations are the previously scaled information items. The Ss' decisions are recorded on questionnaires covering the range of possible decisions. One questionnaire is completed after consideration of the initial information only; two further questionnaires are completed after a group discussion, the first recording the Ss' perception of the group decision, the second the Ss' final decision. A different questionnaire presented at the end of the session provides a measure of satisfaction.

It may be concluded from this investigation that experimental manipulation of both a deviate and a majority in a decision-making group is possible. An increase of overall changes in opinion, and of the deviations of the perceptions of the group norm from the initial opinions, as distance increased, did occur in the LONE Distribution, but only for those group members who held low-valued (non-critical) information initially. Other analyses confirm the major role played by the Distance variable.

The apparent difference between the two types of Distributions was shown to be an artifact. And yet, distribution of information should be considered a major factor, because of its interaction effects. Conforming behavior in the decision-making group containing a deviate was found not to occur, but conformity factors could not be dismissed altogether.

Finally, the importance of two other variables in the decision-making process, information value and the critical nature of this value, were proposed and stressed.

81 pages. $2.00. Mic 57-3349

A STUDY OF THE ATTITUDES OF MOTHERS OF CEREBRAL PALSIED CHILDREN TOWARD CHILD ADJUSTMENT

(Publication No. 21,966)

Vera D. Mann, Ph.D.
The American University, 1957

The object of this investigation was to determine whether and in what respects the attitudes of mothers of cerebral palsied children differ from the attitudes of mothers of normal children in regard to various aspects of child rearing and child development.

It was hypothesized that differences would be found, and that they would be related to factors bearing on the interpersonal distance in the mother-child relationship, over-possessiveness, intrusiveness, dominance and the exercise of maternal control, demand for striving and acceleration of development, objectivity in the parent-child relationship, and on the role of homemaker and parent.

The groups selected for study comprised 66 mothers of mentally normal cerebral palsied children between the ages 3 to 8, and 66 mothers of normal children. The Experimentals and Controls were matched very closely on the following factors: age of mother, education of mother, socio-economic status, religion, race, age of child, and sex of child.

Three separate attitude tests of the disguised-structured type were administered to each mother. The tests included the U.S.C. Parent Attitude Survey devised by E. J. Shoben, the Attitude Test constructed by J. C. Mark, and the Parental Attitude Research Instrument (PARI) recently developed by E. S. Schaefer and R. Q. Bell. The scores made by the two groups of mothers were compared with the aid of the Fisher t-test and other standard statistical procedures. Differences significant at the 0.05 level or better were found for 11 of the 23 PARI scales, 4

of the 9 principal Mark scales, and one of the 3 Shoben scales.

The Experimentals showed on the average a greater tendency than the Controls toward comradeship and sharing, equalitarianism, encouragement of verbalization, intrusiveness, strictness, and a rational approach to parental behavior. The Experimentals display less irritability with the problems of child rearing, less rejection of the homemaking role, less ignoring tendencies, less avoidance of communication with the child, and decreased marital conflict. They also appear to be less lax and ineffectual, and less emotional in dealing with their children.

The results of the present study are at variance with some of the widely held views based on earlier and non-objective investigations. The attitudes of the Experimentals are on the whole quite similar to those of the Normals. The differences found appear to reflect the Experimental mother's attempt to adjust to her special situation and her need for detailed information concerning her child's particular limitations and requirements.

151 pages. $2.00. Mic 57-3350

PREFERENCE ASPECTS OF SELF-ATTITUDES

(Publication No. 22,109)

Carl E. Waisanen, Ph.D.
State University of Iowa, 1957

Chairman: Professor Manford H. Kuhn

The research is guided by a symbolic interaction orientation to the study of human behavior. Within this larger orientation is a system of concepts known as Self Theory. From this theory a set of propositions was derived which pointed to certain hypotheses which were empirically tested.

The general area of investigation is that of personality. The specific research problem concerns attitudes which individuals have toward themselves; i.e., self-attitudes.

The major concept developed in the research is "preferences". It was theorized that a person conceives of himself as one who likes certain social objects and dislikes others. The likes and dislikes of an individual were seen as specific instances of a generalized system of attitudes which the individual possesses. The attitudes which an individual possesses were seen as products of social interaction. Attitudes which express preferences (that is, likes or dislikes toward social objects) were seen as representative of social interaction patterns in which no explicit social statuses had yet developed.

Three propositions were advanced: (1) Preferences are organized. (2) Preferences are persistent. And (3), Preferences determine other behavior. Empirical hypotheses pertinent to each proposition were formulated.

The subjects in the study consisted of eighty-five college students, forty-five females and forty males, who were enrolled in Introductory Sociology and Social Science Core courses.

The methodology of the study derived from the orientation which guided the research. Essentially, the orientation holds that to secure appropriate data one must direct the subject to engage in an "internal conversation". Thus, the instrument for securing data in this study consisted of two sheets of paper on which the subject was instructed to ask himself the following question: What do I like? and What do I dislike? Along with personal data, the statements given in answer to the above questions constituted the data of the study. The data were content analyzed and twenty-six categories were developed. The statements given on the Preference Test were subsumed in the appropriate categories.

A reliability test of the instrument indicated that it secured data which was consistent over repeated measurement. Chi square was the major statistical technique used to determine the presence or absence of relationships among the preference statements, and also among certain preference statements and other known characteristics of the subjects.

The findings supported the hypotheses which were relevant to the propositions at issue. It was found that the preference statements were significantly related to each other. It was also found that preference statements tended to be persistent, and that they were related to indices of other behavior of the subjects.

Supplementary analysis of the social objects toward which the preference statements were directed indicated in general, the feasibility of approaching the concept of "social systems" in an empirical manner. Six structures were developed on the basis of the interrelationships among the statements given on the Preference Test. These structures, in turn, were found to be significantly related to other known characteristics of the subjects. This analysis seemed to support the idea that personality structure and social structure are, indeed, two sides of the same coin.

The conclusions were that the hypotheses of the study had been supported by empirical test. Since the hypotheses were thought logically related to the propositions, support for the propositions seemed to be indicated.

The findings seemed to indicate the validity and vitality of the orientation and theoretical framework which guided the study. It was concluded that although the concept of preferences had indicated initial utility, further research under experimental conditions would be necessary in order to test its significance. 119 pages. $2.00. Mic 57-3351

SOCIOLOGY, GENERAL

AN EXPERIMENTAL STUDY OF THE RELATIONSHIP BETWEEN STRUCTURED BEHAVIOR PATTERNS AND ACCURACY OF SOCIAL SENSITIVITY

(Publication No. 22,098)

Lloyd H. Rogler, Ph.D.
State University of Iowa, 1957

Chairman: Professor Manford H. Kuhn

Various studies have called attention to the fact that chosen leaders excel non-leaders in estimating their group's opinion. One of the explanations for this finding is the proposition that the behavioral patterns existing in the social situation lead to such differentiation in social sensitivity. More specifically, this explanation asserts that the role the leader plays in the complex of the other roles in the group disposes him to be more accurate in his social sensitivity than are the performers of other roles.

Additional research indicates that the phenomenon of the chosen leader specifically has situational meaning; that is, (1) the chosen leader occupies the central position in the network of positions of the group and that (2) he characteristically receives more communications from within the group than do the other members of the group. A three-fold role-playing situation was experimentally created which incorporated these two situational factors. However, during the course of elaborating the experimental roles other situational factors were introduced. Students who did not know one another were randomly assigned to play these three experimental roles. After each one had performed the required task, measurements of his social sensitivity towards his immediate partner(s) were made. Accuracy of social sensitivity was determined by matching ego's estimate of an alter's evaluation of ego with that alter's actual evaluation of ego.

Those situational factors, which served as the points of departure for the elaboration of the experimental roles, were also stated in terms of assumptions which guided the formulation of five main hypotheses of the study. Hypotheses were tested by means of two statistical tests. Three of the five hypotheses proved to be statistically significant.

The clearest indication of the pertinence of structured behavior patterns in the situation may be seen in one hypothesis wherein, in each case, two social sensitivity acts derive from the same ego. In spite of the identity of egos, when one ego enters into a particular kind of role relationship with one alter he is significantly more accurate in his social sensitivity than when he enters into another kind of role relationship with another alter. A conceptualization of social sensitivity as an invariant individual trait or attribute would not explain this finding. Neither would such a conceptualization explain the other statistically verified hypotheses. Subjects were randomly assigned to play roles; consequently, were the social situation unrelated to social sensitivity, significant differences would not emerge between the social sensitivity acts.

When the hypotheses are juxtaposed with the assumptions which guided the formulation of the hypotheses, a basis is provided for a more grounded speculation respecting the importance of specific situational factors. On the basis of comparisons between results of the hypotheses and the respective guiding assumptions it is reasonable to suggest that the reception of information is a relevant situational feature and that the centrality of role is not relevant. This research, however, can only suggest the likely validity of this statement. Future research may more directly test what is only a controlled suggestion here.

122 pages. $2.00. Mic 57-3352

THE EJIDATARIOS' VIEW OF THE EXTENSION SERVICE IN THE STATE OF MEXICO

(Publication No. 22,208)

Humberto Rosado, Ph.D.
Cornell University, 1957

This is a study of the Extension Service in the State of Mexico and the farmers known there as ejidatarios. The ejidatarios operate seven-tenths of all cropland in the State. Nearly half of the State population depends on the ejidal system. Thus, devising effective methods of stimulating efficient agricultural production on the ejidos is one of Mexico's most serious and urgent problems.

Extension programs are rapidly developing in Mexico, but there have been no carefully planned studies outlining the present situation there. Thus, to plan future programs wisely, it was necessary to ascertain what the ejidatarios knew and how they felt about the Extension Service, as a basis for improving the programs and for future evaluations.

The major purpose of the study was an evaluation, by the ejidatarios, of the work done by the Extension Service. More specific objectives were to determine: 1) The extent of the knowledge of the ejidatarios about extension work, channels of communication and relative effectiveness of media used. 2) The extent to which ejidatarios in a given status participate in extension work. 3) The attitudes of the ejidatarios toward the Extension Service and the extension agents, and their opinions concerning the helpfulness of extension programs.

This evaluation was based on the ejidatarios' opinions concerning the work conducted by the Extension Service. The material for the study was obtained in the summer months of 1956 from personal interviews with 304 ejidatarios selected at random from the 992 ejidos in the State. The ejidatarios interviewed were relatively homogeneous culturally and socially, essentially localistic in origin, and relatively immobile on the land.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

The following general statements summarize the specific findings of the study.

1. The Extension Service is well known among the ejidatarios in the State of Mexico and they are generally aware of the scope and diversity of the agent's job.

2. Extension agents and friends and neighbors are the most important media through which the ejidatarios gain ideas that they utilize in their farming.

3. The extent of knowledge about extension work and participation in extension programs was found to be significantly related to differences in type of land tenure, size of plot farmed, and years of formal schooling. Age and migration were found to be related to knowledge and participation in a lesser extent.

4. The ejidatarios who participate the most are those who farm ejido land along with private land, whose plot size is more than 25 acres, who are more highly educated and who are less than 30 years old.

5. Extension agents, and friends and neighbors are the main recognized influences leading to the adoption of the selected practices considered in the study.

6. The general attitude toward the extension service and its agents is definitely favorable. The ejidatarios endorse their agent, and his methods. They believe that the programs are planned for the common welfare of the people and not for one group.

7. The ejidatarios believe that the rural people would get more out of extension work if they were organized into community groups.

This study was a pilot research undertaken in Mexico. The study has identified definite behavior patterns and provided additional evidence that essential information can be obtained directly from the people whom extension programs aim to help. Thus, programs can be based on facts, not on opinions.

The study has also identified many aspects of a broader problem which need further study. The writer expects to continue research which will focus on some of the important problems discovered. 190 pages. $2.50. Mic 57-3353

TOKYO: A DEMOGRAPHIC STUDY

(Publication No. 22,068)

Thomas Oberson Wilkinson, Ph.D.
Columbia University, 1957

This study is a demographic analysis of the city of Tokyo to determine in what respect Tokyo is demographically similar to urban populations of modern Western nations, and whether or not there are similarities in social responses to an urban context.

Modern Tokyo is influenced in socio-economic and spatial patterns by its existence as dominant urban center within the feudal society which preceded the opening of Japan. The impetus for Tokyo's dominance of Japan's urban structure rests not in modern commercial and industrial expansion, but in agrarian feudalism. As administrative capital to the Tokugawa shogunate and as sea outlet for Japan's most productive agricultural plain, Tokyo reached a population estimated to have been 1.4 million in the mid-eighteenth century. Tokyo was the largest of the urban centers which developed in Tokugawa Japan primarily as a response to the shogunate's policy of concentrating feudal lords as permanent residents in strategically important castle towns. These urban populations were further expanded by concentrations of merchants and artisans in these towns to service the needs of the military hierarchy. By allocating income to the feudal lords in the form of agricultural produce rather than direct ownership of land, by prohibiting external commercial activities, and by restricting internal trade, the shogunate effectively bound the military and commercial classes to the existing feudal system. The urban-oriented commercial and industrial leaders who took part in the opening of Japan threw off the seclusionist policies of the Tokugawa, but sought no revolutionary changes in the feudal structure to which they were heavily committed.

Tokyo's population has increased rapidly since the Imperial Restoration (1868). The upward growth curve has been interrupted only by the earthquake of 1923 and World War II bombings. The pattern of growth since 1920 has paralleled that of major Western cities in that it has been centrifugal in character; density in central areas has decreased while outlying areas show consistent increases. Parallels are noted also in concentrations of young, high-potential labor force age groups within the population, in the increasing non-extractive character of industrial structure, and in trends of decrease in fertility and mortality.

The demographic indices for Tokyo which reveal divergences from patterns observed in other of the world's urban areas evolve from unique historical and cultural elements in Tokyo's growth. The socio-cultural complex made up of Tokyo's existence as feudal urban center evolving into modern capital, an oligarchic government's rigid control of the early phases of industrialization, and far-reaching influences of a Confucian family ideal, lends a distinctive character to the composition and activities of Tokyo's population.

The widespread existence of household productive and trade units after the appearance of modern mass production plants in Tokyo reflects a continuation of feudal economic elements. Thus, the development of genuine areas of economic specialization within the city has been retarded. There are, however, indications of significant differentials in social and vital rates which are related to existing levels of ward specialization. A high sex ratio for Tokyo, in contrast to the femininity of Western cities, reflects a variation in cultural definitions of the female role. Migration into Tokyo is proportionally greater in the married status for females than for males. Household industries aid in the preservation of an urban setting within which traditional family values can survive.

Generalizations concerning Japanese urbanization based upon the analysis of Tokyo are limited. The tenacious feudal elements noted in Tokyo, however, are characteristic of the whole of Japanese society. The influence of these elements upon the total Japanese urban population, especially in those cities which appeared after the Imperial Restoration, is an area yet to be investigated.

189 pages. $2.50. Mic 57-3354

SOCIOLOGY, FAMILY

LEVELS OF ASPIRATION AND MARITAL STATUS ON THE COLLEGE CAMPUS

(Publication No. 22,164)

Clyde Melvin Foreman, Ph.D.
University of Washington, 1957

The main purpose of the present study was twofold: (1) to determine whether a sample of married undergraduates could be differentiated from an unmarried group in terms of levels of aspiration, and (2) to determine whether these two groups of undergraduates possessed a differential identity in terms of certain parental home patterns and courtship experiences. A series of null hypotheses were proposed and subjected to the chi square test in each of the two identity areas and in the following areas of aspiration levels: material assets, academic, vocational, marital, and life goals.

The data were obtained by questionnaire from a sample composed of 75 married couples, 101 single females, and 109 single males. The respondents were selected by a random sampling method from the undergraduate student population of Seattle Pacific College.

The results of the study indicated that:

1. The married males generally possessed higher aspirations than the single men in the areas of academic, vocational, and life goals. The single men possessed higher aspirations regarding material assets.

2. The differential aspiration pattern of the females was not generally as marked as the males and was somewhat complicated by the fact that many of the married women were full time housewives; however, the single females had higher aspirations in the areas of material assets, academic, vocational, and marital areas with the wives evidencing higher aspirations in terms of life goals.

3. The courtship patterns of the married males differed from the unmarried in: the greater length of their courtship-engagement period, the exclusive dating pattern which prevailed in their social group, the occasion of their first serious dating activity, the number of serious courtships they had had, the limited parental opposition to early marriage.

4. The wives differed from the single girls in their courtship patterns by: receiving less parental encouragement to date, having longer courtship experiences, experiencing less parental opposition to early marriage.

5. The parental home situations were essentially the same for both groups and both sexes with the exceptions that the married males were more frequently the products of broken homes and had experienced greater economic emancipation from their parents.

6. It would appear that the process of marriage is largely responsible for the higher aspirations of the married male respondents. That is to say, high aspirations are a consequence rather than a precipitant of early marriage.

7. The higher aspirations of the married undergraduate male may be related to the concept that successes lead to a corresponding raising and failures to a corresponding lowering of aspiration levels. Those who have experienced success in marriage may well be the ones with the highest aspirations. In view of the fact that more than three-quarters of the present respondents evaluated their marriages as successful, the attempts to explore this dimension with the present respondents were nullified. This idea should be assessed in another study which would include a more heterogeneous sample with respect to "successful marriage".

244 pages. $3.15. Mic 57-3355

COMPLEMENTARITY AND MARITAL CONFLICT. THE DEVELOPMENT OF A CONCEPT AND ITS APPLICATION TO THE CASEWORK METHOD.

(Publication No. 21,807)

Carol H. Meyer, D.S.W.
Columbia University, 1957

Two concerns prompted the undertaking of this study; the need for useful concepts in social work that are theoretically developed and systematically applied, and the need for a more thoughtful and disciplined approach to social casework with marital conflict.

The study is based upon an underlying assumption of "Complementarity," a concept that describes an emotional tie between marital partners, and is the chief determinant of stability in marriage. Traditionally, marital stability has been viewed either in terms of the individual partner's stability in personality and behavior, or in terms of the partners' fulfillment of marital role expectations as defined by society. Employing both of these viewpoints, the concept of complementarity when used as an additional diagnostic tool, may be helpful in understanding the interaction between the partners and the marital relationship itself.

The study was developed in two major parts; the theoretical evolvement of the concept of complementarity, and a demonstration of its usefulness in casework, through application to fifty cases of marital conflict known to ten family agencies.

In the theoretical development, the problem of marital conflict was analyzed into its component parts: the individual personalities, these individuals as marital partners, and marriage as a social institution. Each of these parts of the problem was examined in the light of a related body of knowledge. Thus, psychoanalytic theory of personality, social role theory and theories of change in the social institution of marriage were integrated into the unifying concept of complementarity.

In the application of the concept to case material, the fifty cases of marital conflict were examined toward the end of demonstrating the usefulness of the concept in casework with marital conflict. The couples' presenting complaints, their general marital functioning and their courtship experiences were studied for the light that could be thrown upon the interaction between the partners and the relative stability of their marital relationships.

The major finding of the study was that some of the marriages remained stable due to the continuance of complementarity between the partners, despite the presence of personality problems, marital conflict or serious marital dysfunction. It was also found that problems in the courtship period did not deter the partners from marrying each other, just as problems in the marriage did not necessarily indicate that the couples wanted to separate.

When marital conflict is the problem brought to family agencies, it seems indicated to diagnose the stability of

the marriage, the gratifications it offers to the couple, and the areas of marital functioning that require strengthening. The use of the concept of complementarity suggests that improved behavior of the partners, or greater fulfillment of their socially defined marital roles may not be the solution to marital conflict, while strengthening of the marital tie or complementarity between the partners may contribute to the maintenance of the marital relationship.

262 pages. $3.40. Mic 57-3356

SOCIOLOGY, PUBLIC WELFARE

CARE OF CHILDREN IN DETENTION

(Publication No. 22,065)

Elliot Studt, D.S.W.
Columbia University, 1957

The development of the detention institution as a child welfare service in the administration of criminal justice for juvenile offenders with the combined functions of holding and serving, is the subject of this study. The development of this service is examined at three levels: i.e., the community organization efforts which have sought to establish and improve this service; the crystallization of these two functions into structure in the creation of one detention program; and the impact of these functions on the detention experiences of 142 children in the same institution.

Three types of materials are examined: (1) The reports of various study groups on detention along with the published and unpublished documents resulting from the work of two detention consultants; (2) the report of an experimental detention program located in Denver, Colorado, from April 1942 through August 1944; and (3) the 142 case histories of children who entered the Denver Detention Home between March 23, 1943 and April 28, 1943.

At each level of the study problems appear as the result of merging the two functions of holding and service. While the analysis of community organization efforts reveals a progressive clarification of the role of the detention institution in the community as a facilitating service for children who require secure custody for a temporary period, it also highlights still unresolved legal and professional issues. Two trends are described, each represented by one of the consultants: one in the direction of separating detention from other agencies of criminal justice through use of a traditional service design; the other supporting a design which emerges from the necessities of both functions.

In the examination of one detention program the combination of the two functions is seen to have produced a major modification in the role of the professional social worker. The necessity of designing a role structure for staff which supports both helping and holding activities is apparent. The impact of perceptions of the service held by relevant groups in the community on service to individual children is also noted.

Examination of the experiences of the 142 children in detention reveals 40 percent actively using help in three different ways. Further study of the cases as examples of interaction among the significant actors in the detention experience--the relevant persons in the community, the child, the institutional peer group, and the staff--produced evidence of four different patterns of interaction. In one of these was discovered an unreached group of children showing marked defenses against mutual relationships with adults.

Treatment in detention is observed to be primarily focussed on helping children deal with severe stress experiences and with the intensification of authority relationships resulting from the fact of detention. The use of controls in relation to treatment emerges as a significant area for the development of skill. The contribution of the detention institution to the diagnostic study of the child is related to its primary treatment responsibility.

Areas identified as requiring further study include the group of delinquent children who conform to corrective measures while holding themselves aloof from treatment with special attention to the peer relationships which reinforce this separateness; the treatment measures which are yet to be designed to reach these children; the process of individualizing the use of controls in treatment; the role structure for staff required to support a service which combines holding with helping; and the means by which such an integrated service can be meaningfully related in the community with the service and law enforcement agencies with which it is identified in function.

427 pages. $5.45. Mic 57-3357

SOCIOLOGY, RACE QUESTION

INTERRACIAL GROUP WORK AND SOCIAL ADJUSTMENT

(Publication No. 21,800)

Claire Landau, D.S.W.
Columbia University, 1957

An effort has been made to explore the role of interracial group work in furthering certain aspects of individual and social adjustment within urban centers in the United States. To this end, we have viewed social group work as a meeting point for various policy-oriented social science hypotheses.

Although adequate solution of problems brought about by racial segregation depends upon thoroughgoing "renovation" of the "rules of the game" governing almost all phases of American life (including housing, educational, occupational and social opportunities), interracial social group work with school-age children can contribute toward an improved state of affairs. Through examining the ways in which racial segregation erects barriers to constructive social adjustment to democratic living, insights may be gained into methods of bringing about improvement.

Racial segregation hinders social adjustment of Americans because it is in direct violation of fundamental American ideals, causing moral conflict among the white population, and a sense of injustice and damaged morale among the Negro population.

Furthermore, it adversely affects development of certain

personal qualities considered necessary to good social adjustment: (1) self-other balance, (2) empathy, (3) correct perception of reality, (4) freedom of choice of group memberships.

Desegregation is a primary condition for permitting first steps toward enhancing social adjustment, as it breaks the vicious circle which segregation sets in motion: segregation lends a semblance of legitimacy to discrimination; discrimination induces the development of "group" characteristics among those discriminated against, which in turn provide rationalizations for discrimination.

While legislation is a powerful means of bringing about greater integration, changes in attitudes and the development of techniques for guiding relationships toward constructive ends, are necessary supplements. Just as a double social standard is learned, so must it be "unlearned", and more democratic patterns substituted. Interracial agencies can provide the conditions within which this process can take place.

Interracial group workers can gain an orientation through examination of the nature of prejudice, assumed direct and contingent societal sources of prejudice, the influence of membership in small groups on individual attitudes and behavior, which can guide efforts to change negative attitudes and reinforce positive ones. Besides such general knowledge, more specific information about groups is required. As each individual and each group is unique, it is necessary to determine the particular program needs of the members at hand, vis-a-vis readiness to engage in interracial relations, in order to select appropriate methods for leading group members toward more advanced stages of democratic interaction. Careful observation, supplemented by the use of relatively simple techniques for gathering data specifically relevant to interracial relations, are proposed. For illustrative purposes, some of the possible uses of two techniques are demonstrated, and some of the implications of the findings for the functioning of the group worker, are discussed.

331 pages. $4.25. Mic 57-3358

SPEECH, THEATER

SPEECH EDUCATION IN THE ENGLISH-SPEAKING TEACHER TRAINING INSTITUTIONS OF CANADA

(Publication No. 22,326)

Pearl Read Campbell, Ph.D.
The University of Wisconsin, 1957

Supervisor: Dr. Gladys L. Borchers

The purpose of the study was to obtain precise information regarding speech education in the English-speaking teacher training institutions of Canada, and further, to interpret such information so that some guide lines for future policies might be established. The findings were placed in a background of the culture of both Canada and the United States because of the very marked influence of the latter upon Canadian thought and Canadian education.

Following the set-up of the study, the first part of the thesis dealt comparatively with the history, the social and cultural life, and the general educational philosophy of both countries. Particular emphasis was placed upon the need for understanding. Relevant American research studies in speech were cited and a section devoted to the history and present status of Canadian English.

Part II of the study concerned the questionnaire which was sent to the thirty-one teacher training institutions of Canada and which attempted to discover where speech education was offered; what elements were stressed; and how much training was given. Opinions of heads of the institutions and of class instructors were requested not only to discover present practices but also to give some indication of possible trends and implications for the future. The response to the questionnaire was 100 per cent. This gave added assurance of validity to the conclusions that were drawn and the findings that seemed indicated. The most important of these were:

Speech education appears to have a fairly firm place in Canadian teacher training institutions; approximately 40 per cent have a speech requirement; about 50 per cent a speech requirement and/or an elective; and about 60 per cent a requirement, elective, or some means whereby speech needs of students are being "adequately met."

There was a high degree of agreement among the respondents that more emphasis should be placed on oral communication--this was somewhat more marked in the replies received from the western provinces.

Much of the speech training is given in English, Language, or Literature classes, rather than in Speech classes per se.

Speech texts presently in use lean heavily to public speaking, more so than appears to be indicated by the many opinions that expressed need for speech correction and individualized work.

Almost all the speech texts in use were American.

There was a marked foreign dialect problem; its prevalency in the provinces being reflected in the teacher training institutions. The most common dialects were French, Ukranian and German, in that order.

The most frequently noted speech fault, aside from foreign accent, was poor enunciation and slurring; faulty articulation, pronunciation, and inflectional patterns were also mentioned.

There was a noticeable emphasis throughout on the value of working individually with students who needed help.

The respondents indicated that basic or fundamental courses were the kind that were needed; also courses stressing remedial work and "clear-cut" speech production.

The most common solutions that were given for speech problems included:

Short intensive courses in Speech
Survey work with follow-up
The overall stress was on the need for more speech training for the classroom teacher.
226 pages. $2.95. Mic 57-3359

AN HISTORICAL AND RHETORICAL STUDY OF THE SPEAKING OF WILLIAM C. PRESTON

(Publication No. 22,227)

Ralph T. Eubanks, Ph.D.
The University of Florida, 1957

William Campbell Preston (1794-1860) was one of the most finished and compelling orators of his times. A South Carolina lawyer, legislator, and educator, he devoted himself zealously to the cultivation of oratory, fulfilling the aspirations of America's Golden Age of eloquence. This study is an analysis and appraisal of Preston as a rhetorician. It directs inquiry into his rhetorical training and practices, ideas on rhetoric, and oratorical effectiveness.

A member of Virginia's First Families with the blood of Patrick Henry in his veins, Preston was reared in a patrician atmosphere of patriotism and political conservatism. He received a classical education, including intensive rhetorical training, and was graduated from South Carolina College. His pre-professional training was completed by a tour of the American West and a period of travel in Europe.

Following a rapid rise to oratorical eminence as a jury lawyer, Preston served three terms in the South Carolina legislature where he became the leading protagonist of nullification. Through an unquieting appeal to South Carolina pride, he achieved his greatest oratorical victory with the Nullification Convention.

In the United States Senate, 1833-1842, Preston established a reputation as a bold defender of state rights and individual liberties. An uncompromising opponent of Jackson, he strengthened the Whig coalition, delivering notable addresses on Jackson's removal of the federal deposits, the expunging resolution, and the abolition petitions issue. Although elected as a Calhoun Nullifier, he broke with his colleague on the Sub-Treasury plan, continuing his rhetorical crusade to wreck the "spoils party." He sat in the Whig ranks during the remainder of his senatorial career, but pursued an independent course, articulating his contentions with his Republican state rights creed.

In 1840 Preston became one of the leading stump champions of Harrison, delivering at least fourteen major speeches in the South and East. Though hampered by declining health in 1844, he again went before the people to urge the election of Clay. His refusal to follow Calhoun wrought his political downfall in South Carolina, and in 1842 he resigned his Senate seat rather than obey the legislature's instructions to oppose re-establishment of a national bank.

During the closing years of his life Preston served with distinction as president and professor of belles lettres of South Carolina College, and promoted various cultural projects, chief of which was an athenaeum for the city of Columbia.

Preston formulated no systematic theory of rhetoric, though he speculated on the subject. He regarded oratory as indissolubly wedded to ethics and politics, emphasized the importance of appealing to man as he is, and stressed the importance of stylistic elegance.

Preston achieved genuine stature as an orator, employing with competence the rhetorical resources available to him. He was at his best in ceremonial address and on the hustings. As a legislative speaker, however, his logical appeal was weakened by the hobgoblin of political consistency and his inability to evolve appropriate programs for social action. His strong moral character and skill in commanding his listeners' emotions compensated in some measure for his deficiences in logical invention. He was a phrase-smith, an illuminator and dramatizer of schemes and ideas, developing a feverish, pictorial style, and a fluent, impassioned extempore delivery, which led to his apotheosis as "the Inspired Declaimer." Many of his compeers excelled him in ability to create the arrows of oral suasion; few surpassed him in ability to feather the arrows with vivid, Saxon English, and compelling delivery. Through his service to his contemporaries he became a symbol of America's Golden Age of oratory as it promoted conservative idealism. 532 pages. $6.75. Mic 57-3360

THE NEW MEMPHIS THEATER OF MEMPHIS, TENNESSEE, FROM 1859 TO 1880

(Publication No. 22,079)

Seldon Faulkner, Ph.D.
State University of Iowa, 1957

Chairman: Dr. William R. Reardon

This study is one of three dissertations which attempt to clarify the story of theatrical activity in Memphis, Tennessee, from the beginning to 1880. The history of the New Memphis Theater, the city's leading legitimate playhouse from 1859 to 1880, is covered in this study.

Primary sources utilized in the study include the following: Memphis newspapers of the period; official city archives, such as court, tax, and license records; public reports and documents; and playbills of the New Memphis Theater. In addition, a number of secondary sources were examined and utilized in varying degrees.

The organization of the study is chronological. Consideration is given to New Memphis Theater personnel, the audience, and program offerings. Events significant to the city, and which affected theatrical activity, are also examined and recorded.

The history of the New Memphis Theater falls into five periods from 1859 to 1880. The first, 1859 to 1861, showed the New Memphis operating with a resident stock company. They displayed their talents in support of stars, who visited the theater during seasons which ran from mid-September to April or May. The audience came from the family trade of Memphis, although other classes also patronized the theater. Programs normally contained either a serious or comic play and an afterpiece, usually a farce.

The capture of Memphis by Union forces in June, 1862, marked the beginning of the second period of the New Memphis' history. A change occurred in the town and was

reflected in the theater. Northern merchants, Federal troops, and the inevitable followers of armies, poured into Memphis. Because women hesitated to venture out at night in this rowdy town, the New Memphis' audiences became primarily male. Because of its owner's alleged Confederate sympathies, the New Memphis was confiscated by the Union and leased to a Unionist militiaman. The period was marked by the infrequent appearance of stars and the emphasis by the stock company on performances of plays written in the previous half-century.

The third period of New Memphis Theater's story began when the war ended. The theater returned to its former mode of operation. The star and stock system showed moderate success, but the post war recovery of the town was retarded by an epidemic of yellow fever in 1867.

In 1869, the New Memphis managerial lease was acquired by the firm of Spaulding, Bidwell, and Macdonough, which also controlled theaters in St. Louis, New Orleans, and Mobile. A loose circuit arrangement was inaugurated, with the New Memphis Theater participating. The operation was not overly successful in Memphis and expired in 1873. During this period, programming revealed a mixture of dramatic plays and novelty spectacle shows which utilized elaborate scenery and stage effects.

From 1873 to 1880 the story of the New Memphis Theater follows a pattern similar to the city's. Staggering under the burden of municipal debt and a terrifying succession of yellow fever epidemics in 1873, 1878, and 1879, Memphis needed drastic reforms in government and stringent sanitary measures in order to survive. Panic, fostered by the epidemics, drove many patrons of the theater out of Memphis; in an attempt to draw new patrons from other sections of the population, the management offered a programming blend of variety performances and straight dramatic fare. The economic chaos, brought on by the plagues and municipal mismanagement, resulted in fiscal difficulties for the owners of the New Memphis and finally forced them to sell, because of delinquent taxes, in 1879. Although the theater was to continue beyond 1880, its course was to be determined by the distinctive character of the new city of Memphis.

314 pages. $4.05. Mic 57-3361

A RITE-ROLE ANALYSIS OF THIRTEEN IBSEN PLAYS

(Publication No. 22,453)

William Alfred Gregory, Jr., Ph.D.
University of Minnesota, 1957

The study is an application of the rite and role technique of play analysis, developed by Professor David W. Thompson of the University of Minnesota. The purpose of the study is two-fold: First, to discover the presence of rite and role in Ibsen's dramas; and second, to reach a clearer understanding of the plays through a rite-role analysis.

Rite is defined as any situation or ceremony enacted by a group of characters or an individual which has a recognizable pattern. Rites are composed of dramatic actions. Dramatic actions are defined as main lines of action as found in the dialogue or in the physical action implied in that dialogue.

Role is defined as a pattern of action maintained by an individual character long enough to be recognized as a significant pattern. Role is used on four levels of meaning: conscious role, semi-conscious role, unconscious role, and single role. A conscious role player is one who is recognized by the audience as a role player and can also see himself acting. A semi-conscious role player is one who appears to have some knowledge of his play-acting, but refuses to admit it to himself. An unconscious role player is one who is recognized by the audience as he plays his role but who does not recognize his own acting. A single role player may be conscious, semi-conscious or unconscious in his playing, but appears in only one role.

The term "maimed" is applied to both rite and role. A maimed rite is one which is either incomplete or out of proportion in the play's context. A maimed role indicates either a physical or mental disability.

The study includes a complete rite-role breakdown of Ghosts and The Wild Duck. The remaining eleven plays are treated in less detail. Chapter I, "The Attempt to Achieve a Role," includes analyses of The League of Youth, An Enemy of the People, and John Gabriel Borkman. Chapter II, "The Attempt to Retain a Role," includes analyses of Pillars of Society, A Doll's House, and The Master Builder. Chapter III is devoted to an analysis of Ghosts, described as, "The Play of the Maimed Rite and Maimed Role." Chapter IV is concerned with The Wild Duck, described as, "The Play of the Satisfied Role Players." Chapter V, "The Attempt to Choose Between Roles," discusses The Lady from the Sea. Chapter VI, "The Attempt to Escape from a Role," includes analyses of Rosmersholm, Hedda Gabler, Little Eyolf, and When We Dead Awaken.

The analyses appear to demonstrate the presence of rite and role within the dramas discussed. The concept of role players acting within well defined rites does appear to make evident similarities and contrasts, which otherwise might be difficult to recognize, and thus aids in reaching a clearer understanding of the dramas.

The analyses would also seem to suggest the importance of the conscious role player to successful drama. The conscious role player is apparently, if not necessary, at least highly desirable.

The analyses also suggest a means of classifications of drama from a role viewpoint, as suggested by Chapter I, II, V, and VI, and also the possibility of a rite classification.

447 pages. $5.65. Mic 57-3362

A COMPARISON OF THE ORAL LANGUAGE OF SCHIZOPHRENICS BEFORE AND AFTER PREFRONTAL LOBOTOMY

(Publication No. 22,360)

Emma May Testai Heller, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor John V. Irwin

Problem.

The purpose of this study was to investigate the oral language of 14 long-term schizophrenics before, and at

certain intervals after, bilateral prefrontal lobotomy, and to compare these findings with those for matched schizophrenic controls who were interviewed at corresponding intervals over a ten month period.

Procedure.

The controls were matched person to person, as closely as possible, to the lobotomy patients with regard to sex, age, subdiagnosis, marital status, educational level, occupation, duration of illness, duration of hospitalization, and treatment.

Each patient was presented with the same set of interview questions at five times: within the week before lobotomy, within the week after lobotomy, one month after lobotomy, three months after lobotomy, ten months after lobotomy. Interviews were tape recorded and transcribed.

The factors analysed were five external language factors: total number of words per interview, number of words per minute, clarity of articulation, speech melody, vocal intensity, and four content language factors: scatter, perseveration, neologisms, literalness.

The data were treated statistically using paired comparisons and comparison of means.

Findings.

Preoperatively, the lobotomy group showed a significantly higher incidence of neologisms than the controls.

Immediately postoperatively, the lobotomy patients showed significant decreases in total number of words per interview, number of words per minute, and speech melody. The lobotomy group had significantly fewer total number of words, fewer number of words per minute, less clarity of articulation, less speech melody and more scatter than the controls.

Three months after lobotomy, the lobotomy patients showed significant increases in literalness and neologisms. The lobotomy group showed significantly more vocal intensity than the controls.

Ten months after lobotomy, the lobotomy patients showed significant decreases in clarity of articulation, speech melody and vocal intensity. The lobotomy group had significantly more literalness and poorer clarity of articulation than the controls.

Conclusions.

The schizophrenics selected for lobotomy were somewhat more disorganized in their oral language content than their controls.

The immediate effect of lobotomy on the oral language of these schizophrenics was a deterioration of certain external factors of language.

Three months postoperatively, the lobotomy patients showed deterioration of certain content factors of oral language, which was attributable to lobotomy.

Ten months postoperatively, the lobotomy patients showed deterioration of certain external factors of oral language, partially attributable to lobotomy and partially to the progress of schizophrenia, unaffected by lobotomy.

The controls showed fluctuation of most oral language factors within the ten months of this study. There was evidence in the controls of reduction in perseveration over the ten month period. There was deterioration of speech melody and vocal intensity, which may be characteristic of the progress of schizophrenia.

There was no evidence of significant improvement in the lobotomy group in any aspect of oral language investigated in this study over the ten month period.

121 pages. $2.00. Mic 57-3363

ELECTROMYOGRAPHIC STUDY OF RESPIRATORY MUSCLES IN RELATION TO SYLLABICATION

(Publication No. 22,260)

Michael S. Hoshiko, Ph.D.
Purdue University, 1957

Major Professor: T. D. Hanley

A survey of the literature on the use of the electromyographic technique in speech research indicates that aside from Stetson's original investigation conducted over twenty-five years ago, little has been done except for studies of the masseter muscles of stutterers. The purpose of this investigation was to give a descriptive analysis of the internal intercostal muscles, the rectus abdominis muscles and the external intercostal muscles as inferred from the action potential patterns as recorded by the electromyograph. The primary purpose was to determine in what temporal sequence these three muscle groups fell in preparation for and during the utterance of syllables.

The procedure employed consisted of the following basic steps:

1. Recording of action potentials from the three muscle groups under conditions of vegetative breathing, breathing in preparation for speech and during the utterance of discrete and connected syllables, at slow and rapid rates.
2. Measurements and qualitative analysis of electromyograms recorded from the three muscle groups under the various conditions of breathing and speaking.

Electromyograms were secured from twelve adult male subjects during speech breathing with an additional four subjects during vegetative breathing. Electromyographic apparatus consisted of a Grass P5 Pre-Amplifier and a dual-beam cathode-ray Du Mont oscilloscope which was photographed by means of a Fairchild Oscillo Record Camera.

The results during silent breathing indicated that the internal intercostal muscles showed activity for inhalation in six out of the fifteen cases. For the rectus abdominis muscles, three indicated activity during expiration, two during inspiration and five did not show any activity during quiet breathing. From the external intercostal muscles activity was present for inhalation in three records while activity for both inhalation and exhalation was seen in two records and the remainder were too indefinite to be evaluated. All three records from the diaphragm indicated activity for inhalation.

Conscious inhalation of air for speech produced marked activity from the internal intercostal muscles of eight subjects. Five records from the rectus abdominis and seven from the external intercostal muscles indicated definite activity. In some records, the action potentials remained continuous with the expiratory phase of syllable utterance

and no recognizable break could be seen. During the utterance of connected material at a rate of 3.5 syllables per second discrete action potentials were not seen concomitant with all the syllables from the internal intercostal muscles as would be expected from Stetson's hypothesis. Also at this rate the rectus abdominis muscles should have been in a contracted state, but the results indicated that some were able to continue pulsing discrete bursts of action potential at this rate. Intercostal activity in arresting syllable pulses, previously attributed to the external intercostals, was not observed.

The results indicated that breathing muscles normally inspiratory in function during quiet breathing may become expiratory in function. Two subjects were tested during phonation of discrete [a] vowels on successive inhalations from the intercostal muscles. The results indicated that these muscles are capable of multiple function. Stetson's assumption that breathing muscles function in the same manner for speech as for vegetative breathing could not be accepted.

The temporal sequence of the muscles involved in phonation of the discrete vowel [a] and the syllable "pup" at slow and rapid rates indicated the order of initiation to be: (1) internal intercostal muscles, (2) rectus abdominis muscles and (3) external intercostal muscles. The same order of onset was seen for the two types of syllables for the two rates of utterance. The pattern of action potential activity indicated that the muscles have an onset sequence pattern which is maintained in spite of changes in speech material and rate of utterance. In the sequence of termination of action potentials, the rectus abdominis muscles were the first to cease activity for both slow and rapid utterances.

At the rapid rates of utterance the syllable utterance was more uniform, which tended to support Stetson's hypothesis that the fast ballistic movement improves accuracy. 139 pages. $2.00. Mic 57-3364

AUDITORY THRESHOLD VARIATIONS ASSOCIATED WITH STIMULATION BY SUSTAINED VOWELS

(Publication No. 22,301)

James Carr Teegarden, Ph.D.
Purdue University, 1957

Major Professor: T. D. Hanley

A search of the literature involving investigations into auditory fatigue and related studies revealed no investigation into the relationships between this auditory experience and speech. An investigation was designed to study the effects on hearing at threshold of auditory stimulation by selected vowels at specified sensation levels, measured at certain frequencies. The study was designed to answer the following questions:

1. In post-stimulation testing, are the auditory threshold shifts attributable to vowels, sensation levels, test frequencies and subjects significant?
2. Are the delays in auditory threshold returns associated with vowels, sensation levels, test frequencies and subjects significant?

In addition to these primary considerations subjected to statistical test, the experiment was designed to yield descriptive data on such auditory phenomena, associated with fatiguing stimuli, as heightened sensitivity, pseudo-recruitment, and diphasic threshold return, or "bounce."

In the experiment, fifteen normal hearing subjects participated in a series of experimental sessions, each of which consisted of three successive steps: 1) a pre-stimulation threshold determination at a specified frequency, 2) a one-minute auditory stimulation by sustained vowels at a predetermined sensation level, and 3) a post-stimulation threshold determination for the frequency under scrutiny.

The three vowel stimuli, [i], [a], and [u] were chosen on a judgmental basis from 60 vowels produced by 10 male speakers. Each of the three vowels was subjected to analysis by an audio-frequency spectrometer, the results of which helped to determine what frequencies within the auditory range should be subjected to pre- and post-stimulation testing. An analysis of variance technique was used to establish the effects and interactions of vowels, sensation levels, and frequencies on two auditory variables: threshold shift and threshold return. Thirty randomized combinations of three conditions of vowel, two conditions of sensation level and five conditions of frequency were presented to a subject.

The two analyses of variance yielded a substantial number of statistically significant results. Moreover, there were found an appreciable number of the associated auditory phenomena for which observational data had been sought. Based upon these statistical and observational findings, and qualified by the limitations imposed by the experimental procedure, the following major conclusions, selected from a larger body of such conclusions, are believed to be justified.

A. In post-stimulation testing, significant differences in the amount of threshold shift are found.
   1. Sensation levels: stimulation at the 60 db SL produces greater shifts than stimulation at a 20 db SL.
   2. Frequencies: in general, the frequencies contributing the most energy to the vowels produce the greatest shifts.
   3. Vowels by sensation levels (across all frequencies): There is more threshold shift variability after vowel exposures at the 20 db SL than the 60 db SL. The threshold shift difference between the 20 db and the 60 db SL is greater for the [a] vowel than either the [i] or the [u] vowel for the frequencies tested.
   4. In general, markedly greater threshold shifts are revealed following [i] and [u] vowel exposures than those which are revealed following [a] vowel exposures; and an unexplained result was the relatively large threshold shift at 2500cps for the a vowel, which contained relatively little energy at that frequency.
   5. Sensation levels by frequencies (across all vowels):
      a. The most marked shifts in threshold attributable to vowel stimulation are to be found in the low frequencies (160 and 320 cps) at the 60 db SL.
      b. The least difference between levels is revealed for the 1000 cps tone.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

c. With the exception of 320 cps at 20 db SL, any one of the frequencies reveals a greater shift following stimulation at the 60 db SL, than is reflected in any one of these tones following stimulation at the 20 db SL. The 320 cps tone at 20 db SL reveals slightly more shift than either the 1000 or 1200 cps tones at the 60 db SL.

B. In post-stimulation testing significant differences in the time of threshold return are found, attributable to the following:

1. Vowels by frequencies (across all sensation levels):

a. The pattern of threshold returns is similar for the [i] and [u] vowels--relatively slow threshold return at the low test frequencies and rapid at the higher frequencies.

b. The threshold return behavior at the 2500 cps test frequency shows a reversal in this pattern--there tends to be slower threshold return at this frequency.

2. Levels by frequencies (across all vowels):

a. The mean time of threshold return is about the same after 20 db and 60 db. SL exposures.

b. Frequencies which reveal rapid threshold return at 20 db SL tend to reflect slower return at 60 db SL.

C. Although there are apparent differences between threshold shifts and threshold return as tests of the effects of auditory stimulation by vowels, in general they exhibit co-variation: points of greater threshold shift tend also to be points of greater delay in threshold return.

D. The associated auditory phenomena labeled by previous investigators, heightened sensitivity, "bounce" and pseudo-recruitment were observed in limited number in the auditory test records collected in this experiment. None of these phenomena was detected in more than 20 per cent of the 450 post-stimulation tests administered. "Bounce" appeared in the auditory record far less frequently than the other two phenomena.

108 pages. $2.00. Mic 57-3365

AN ANALYSIS OF THE RHETORICAL SITUATION AND RHETORICAL CHARACTER TYPES IN SELECTED PLAYS OF GEORGE BERNARD SHAW

(Publication No. 22,481)

Jere Shanor Veilleux, Ph.D.
University of Minnesota, 1957

Adviser: D. W. Thompson

This thesis attempts to explore some of Shaw's plays in terms of their rhetorical patterns in response to the great volume of Shaw criticism which attacks the plays for being "talky," "rhetorical," and "propagandistic." The unique method of analysis employed in the thesis is the examination of the rhetorical situations within the plays and Shaw's consistent use of rhetorical character types within those situations.

The inner rhetorical situation consists of any situation within the play itself in which a character is engaged in persuasion with another character in terms of a particular, compelling idea. Upon looking closely at Shaw's plays it was discovered that three basic character types recurred in most of the plays. These are: the professional rhetorician, a character who talks for the sake of talk, who usually represents a particular profession, is partially a fool or buffoon, and frequently over self-confident and romantic; the natural rhetorician, a character who persuades others more by what he is or does than by language, usually a representative of youth and rebellion, and frequently the character who must eventually choose between ideas expressed in the play; and the master rhetorician, a character who represents age and experience, who is often mad or eccentric, and who talks only when compelled to do so. The utility of this method of analysis is that it allows a more complete view of the motives and justifications behind the ideas of the play than other classifications may permit.

A brief examination of John Bull's Other Island, Fanny's First Play, and a section of Back to Methusaleh is made is made as illustration of the method of the thesis. Five plays are then examined in detail: Candida as a play with a domestic theme; Man and Superman as a play with a philosophical theme; Major Barbara as a play with a social theme; Heartbreak House as an example of Shaw's criticism of his own dialectic; and Saint Joan as an example of Shaw's serious rhetorical drama. The last chapter discusses some rhetorical variants in other plays and presents examples of two plays, Mrs. Warren's Profession and Widowers' Houses, for which the traditional adverse Shavian criticism may be warranted.

The conclusion of the thesis is that the critics' case against Shaw is an untenable one, and that Shavian drama actually constitutes a consistent dramatic convention. The nature of this convention involves a series of rhetorical situations with rhetorical character types. These character types are involved in a discussion of an ideological problem, viewed from a comic angle within a dramatic action. The result, as illustrated by the analyses of the thesis, is a dialectical author-audience relationship.

Thus, the thesis shows that Shaw, far from being "propagandist" or merely "talky," developed his own dramatic convention--a many sided dialectic rather than a partisan rhetoric--which his audiences finally accepted. Furthermore, the study illustrates that the inner rhetorical situation and the three basic rhetorical character types were sufficiently flexible to allow Shaw to express a many sided ideological problem within a dramatic framework. In this manner both the author and the audience are allowed to function as critics of ideas and of rhetoric itself.

It is hoped that this thesis may help to accomplish a re-evaluation of Shaw's method which, in turn, will help reveal his stature as a dramatist; illustrate the particular contribution which Shaw has made to the discussion of ideas in the modern theater; and clarify the distinction between internal rhetoric and external, propagandist rhetoric as used by the dramatist. 242 pages. $3.15. Mic 57-3366

VOWEL FORMANT FREQUENCIES AND VOCAL CAVITY DIMENSIONS

(Publication No. 22,112)

Ronald W. Wendahl, Ph.D.
State University of Iowa, 1957

Chairman: Professor James F. Curtis

This study concerns the effect that vocal cavity volume has upon the determination of vowel formant frequencies.

Six subjects, three males and three females, were selected to represent a large range in total volumes of the vocal tract. These individuals were subjected to a large number of measuring techniques so that the cross-sectional areas of the entire vocal tube, from the glottis to the lips, could be estimated.

The measuring techniques included lateral x-ray photographs of the mid-saggital plane of the vocal tract, laminagraphic x-ray photographs of the mid-coronal plane of the vocal tract, palatograms, dental casts, and still pictures of the lip aperture of the subjects phonating each of five experimental vowels.

A spectral analysis of the vowels produced by the subjects was compared to the volume in the vocal tract for each of the subjects to ascertain whether vowel formant frequencies are entirely dependent upon vocal cavity volumes.

The results of the cross-sectional measures were sent to the Acoustics Laboratory at the Massachusetts Institute of Technology and appropriate settings were made on an analog of the vocal tract developed by Stevens, Kasowski and Fant in order to provide a check on the validity of the measuring techniques. Spectral analysis of the vowels produced by the electrical vocal tract compared very favorably with the spectral analysis made of the subjects' productions. These comparisons indicated that the measuring techniques were relatively free from error.

The correlations between vowel formant frequencies and vocal cavity volumes indicate that a significant relationship exists between formant frequencies and volume but the correlation is not high enough to say that the total volume of the vocal tract is sufficient to determine the formant frequencies for any vowel. Instead, a number of factors operate to determine the actual formant frequencies. One must also consider the amount of constriction due to the tongue-hump, the point at which this constriction occurs, and the amount of mouth opening.

The results from this study indicate that the dimensions of the vocal tract can be measured accurately with present techniques and also substantiate the assumptions that went into the construction of the electrical vocal tract.

159 pages. $2.10. Mic 57-3367

METABOLISM OF CERTAIN ORGANOPHOSPHORUS INSECTICIDES INCLUDING PHOSPHORAMIDES, ETHYL PHOSPHONATES AND PHOSPHORODITHIOATES

(Publication No. 22,315)

Belton Wayne Arthur, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor John E. Casida

The metabolism of three classes of organophosphorus insecticides--phosphoramides, ethyl phosphonates and phosphorodithioates--was investigated using radiotracer techniques.

The metabolism of dimethylphosphoramides was studied with particular emphasis on tetramethylphosphoradiamidic fluoride (dimefox), octamethylpyrophosphoramide (schradan) and hexamethylphosphoramide. Several active anticholinesterase agents were formed from biological or chemical oxidation of dimefox; the most active of these antiesterases was a more polar derivative of dimefox which hydrolyzed readily in water and yielded free formaldehyde on treatment with acid. The principal biological metabolites of dimefox and schradan were less polar but more active antiesterase agents than the parent compounds. Except for the greater instability of dimefox and its derivatives, the nature of the intermediates in dimefox metabolism appear to be similar to those formed in schradan metabolism.

More than forty 0,0-dialkyl 2,2,2-trichloro-1-hydroxyethyl and -1-acyloxyethyl phosphonates and related derivatives were synthesized and their biological activity investigated. 0,0-dimethyl 2,2,2-trichloro-1-n-butyryloxyethyl phosphonate was the most selectively toxic to houseflies compared with rats of the dialkyl substituted-ethyl phosphonates. This material was designated as "butonate" and offers potentiality for use as an insecticide of low mammalian toxicity in the control of household insects. Radiolabeled butonate was debutyrylated in insects and mamals to form 0,0-dimethyl 2,2,2-trichloro-1-hydroxyethyl phosphonate (dipterex). Butonate was not stored in the fat of rats and was excreted in the urine as mono- and dimethyl phosphoric acids. The chloral portion of the dipterex molecule was excreted in the urine of a dog primarily as trichloroethyl glucuronide. The low mammalian toxicity of dipterex and butonate may be attributed to phosphonate hydrolysis by plasma esterases or possibly in vivo hydrolysis of the O-methyl ester group.

The components of the phosphorodithioate insecticide known as Navadel were characterized and their metabolism by insects and mammals investigated. The most active components of technical Navadel consist of about 70% of the cis and trans isomers of 2,3-p-dioxanedithiol S,S-(0,0-diethyl phosphorodithioate) in a 1:2 ratio and about 6% of 2-p-dioxenethiol S-(0,0-diethyl phosphorodithioate) along with 10% of an incompletely characterized fraction. The cis and trans isomers were more biologically stable than the other components. Several biological systems metabolized the Navadel fractions to non-ionized more polar derivatives which were presumably the oxygen

analogs of the parent compounds. The liver appears to be the site of in vivo detoxification of Navadel in rats.

The metabolic reactions demonstrated in these studies include oxidation of phosphoramides and phosphorodithioates, the hydrolysis of phosphonates, phosphoramides and phosphorodithioates and a conjugation-type reaction. Selectivity between insects and mammals was demonstrated for certain of these metabolic steps.

103 pages. $2.00. Mic 57-3368

SOME EFFECTS OF NUTRITION AND PHYSIOLOGICAL STRESS ON THE HOST PARASITE RELATIONSHIP BETWEEN THE LAMB AND ITS NEMATODE PARASITE HAEMONCHUS CONTORTUS

(Publication No. 22,318)

William Joseph Bemrick, Ph.D.
The University of Wisconsin, 1957

The stomach worm, Haemonchus contortus, is one of the most important pathogenic parasites of sheep in the state of Wisconsin. Because of its importance to those engaged in sheep husbandry a great deal of work has been done on the parasite, on its effects on the host, and on the control of the infection in the host.

Over the past four years two general types of experiments were performed using lambs infected with Haemonchus contortus. One experiment was designed to compare, under field conditions, the protection offered by the anthelmintic phenothiazine with that afforded by dicalcium phosphate. The lambs had access to both of these compounds, free choice, in their trace mineralized salt supplement. The phenothiazine was administered as 10% and the dicalcium phosphate as 25% of the total salt mixture. The lambs were infected with 20,000 H. contortus larvae each and turned out on the pasture, where they remained for approximately five months. Data were collected on egg counts, hemoglobin values, carcass grades and total worm counts. The results, over the four year period, indicated that lambs infected with H. contortus receiving 25% dicalcium phosphate while on an infected pasture did as well as those receiving 10% phenothiazine with respect to the factors studied. The animals that received a combination of 25% dicalcium phosphate and 10% phenothiazine seemed to do slightly better than those on either dicalcium phosphate or phenothiazine alone.

Two experiments were designed to establish the effect of the following on the ability of lambs to withstand a challenge infection of the parasite: bleeding animals by jugular puncture, feeding iodinated casein, or a previous infection with H. contortus. The results indicated a similar degree of resistance to stomach worm infection in bled and previously infected animals upon challenge with a heavy dose of infective Haemonchus larvae. In comparison, the untreated control lambs showed little resistance. The results also indicated that animals which had received iodinated casein, at a high enough level to upset their metabolism, seemed to be more susceptible to the effects of a challenge infection. The infection in this group of lambs was more than any of the other lots on the experiment. This was true even though, during the experiment in which iodinated casein was used, the infection was not heavy in any of the groups, including the controls.

144 pages. $2.00. Mic 57-3369

CHANGES IN TOTAL BLOOD, ERYTHROCYTE AND PLASMA VOLUMES IN THE RAT RESULTING FROM ALTERATIONS IN VARIOUS ENDOCRINE SITUATIONS

(Publication No. 22,114)

Charles Farrington Bond, Ph.D.
Cornell University, 1957

Purpose.

A study has been made in the rat of changes in blood volume and its components resulting from alterations in various endocrine situations.

Procedure.

Standard hematological procedures were employed to measure hemoglobin concentration, hematocrit value and plasma protein concentration. Total blood, erythrocyte and plasma volumes were determined by a rapid, reliable dye-dilution (T-1824 dye) method developed for use in the intact rat. From blood and body weight data various indices and ratios were calculated.

The experimental groups of rats included, in addition to animals subjected to starvation or hemorrhage, 1) normal rats injected with epinephrine, 2) normal and adrenal demedullated rats injected with histamine, 3) hypophysectomized rats maintained on a high-protein diet, some of which also received injections of insulin, 4) pseudopregnant female rats, with and without deciduomata, 5) pregnant rats, fetuses removed from some on the 13th day of pregnancy, 6) female rats injected with ovarian hormones, and 7) lactating rats.

Findings and Conclusions.

1. The volume of circulating erythrocytes is similar in both sexes in the rat, but the plasma volume is larger in females.
2. In starvation, body weight and plasma volume decrease proportionally, but the volume of circulating erythrocytes is not altered significantly.
3. The plasma volume is larger in Nembutal-anesthetized than in ether-anesthetized rats. This difference is abolished by adrenal demedullation. There is no difference in erythrocyte volume due to anesthesia.
4. Within five minutes after intravenous injection of physiological amounts of epinephrine into Nembutal-anesthetized rats, the plasma volume is reduced significantly while the erythrocyte volume is unchanged. The effect is maximal approximately ten minutes after injection.
5. Intravenous injection of small amounts of histamine also causes a temporary decrease in plasma volume with no change in erythrocyte volume, and the effect is not prevented by adrenal demedullation.
6. In hypophysectomized rats the plasma volume/body weight ratio is lower than in intact rats. This ratio is not altered by body weight changes concomitant with the use of a standard diet and a high-protein diet, with and without injection of insulin. The characteristic symptoms of

post-hypophysectomy anemia do not appear in young hypophysectomized animals. The erythrocyte volume/body weight ratio in hypophysectomized rats is increased significantly by an enriched diet.

7. In pseudopregnant rats an anemia develops which is equivalent to that found on the 13th day in pregnancy, and in both instances the anemia is primarily the result of hemodilution. The blood changes in the first nine days of pseudopregnancy are independent of the deciduomata, but the maximum changes occur at the time deciduomata are maximum in size.

8. The removal of fetuses in mid-pregnancy does not significantly alter the blood picture characteristic of normal pregnancy in the rat.

9. Estradiol benzoate injected daily into female rats in doses large enough to induce pseudopregnancy inhibits body weight gain and induces a decrease in erythrocyte volume. On the other hand, progesterone injected daily into female rats for three weeks accelerates weight gain, increases erythrocyte volume, inhibits the normally expected increase in plasma volume, and decreases plasma proteins.

10. Total blood, erythrocyte and plasma volumes increase spectacularly in lactating rats. The author has termed the increase in erythrocyte volume "lactation polycythemia." The blood changes are independent of the number of young suckled.

11. Various possible mechanisms by which hormones may regulate blood composition and volume have been discussed. 161 pages. $2.15. Mic 57-3370

FASCIOLOIDES MAGNA (TREMATODA) WITH SPECIAL REFERENCE TO THE ADULT IN RELATION TO DISEASE

(Publication No. 22,327)

William Cecil Campbell, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor A. C. Todd

The dissertation consists of two parts, the first being a continuation of a previous study of the larvae of Fasciloides magna, the large American liver-fluke (Campbell, W. C., M.S. degree thesis, Univ. of Wisconsin, 1954) and the second being a study of the disease produced by this parasite.

In Part I experiments are reported which have led the author to conclude that miracidial penetration of the molluscan host is not the result of random contact, but is governed by a chemotactic response. Observations on the emergence of cercariae include a report of the emission of cercariae and metacercariae in snail feces. Evidence is presented which suggests that the outer cyst may be tanned in a manner similar to the tanning of the egg-shell.

In Part II the distribution of F. magna in the U.S. and in Wisconsin is reported, and the gross pathology of fascioloidiasis in deer, cattle and sheep is described. In deer and cattle the flukes invariably are found inside fibrous capsules in the liver, while in sheep they are usually not encapsulated. Complete capsules, with open bile ducts have, however, been found by the author in seven naturally infected sheep. Sheep are frequently killed by Fascioloides infection, whereas deer appear to be very tolerant. The experiments described in Part II were designed to clarify the mechanisms governing this differential pathogenicity.

Attempts to induce an anaphylactic response by injecting fluke extract into previously exposed sheep were unsuccessful, but the tests were few in number and an acquired hypersensitivity of sheep to F. magna remains a distinct possibility. The severity of the infection in sheep may also be due to mechanical disruption of liver organization; in deer and cattle the destructive burrowing of the flukes in the liver is checked by encapsulation. Bromsulphalein dye excretion tests, however, showed no depression of the detoxification function of the liver of sheep suffering from fascioloidiasis, which suggests that morbidity in this host may be due to something other than the destruction of hepatic cells.

It is proposed that encapsulation, where it occurs, may afford protection by enclosing, and safely eliminating, toxic parasite products which might act as systemic toxins or as inhibitors of specific enzyme systems. Injection of pigmented intra-capsular material from deer livers into a lamb did not elicit a detectable reaction. Studies on the nature of the pigmentation associated with fascioloidiasis, including a spectrophotometric study, have indicated that the pigment is hematin (and not melanin, as has been suggested). Hematin is known to inhibit succinic dehydrogenase activity, and experiments were carried out to compare the rate of oxidation of sodium succinate by infected and noninfected sheep liver. These experiments did not show a depression of succinate oxidation in sheep infected with F. magna. Nevertheless it is suggested that the clinical effects produced in sheep are more likely to be due to a toxin or anti-metabolite than to mechanical damage.

The author submits that the differential pathogenicity of F. magna in its three definitive host types is dependent, not upon the type of host reaction, but upon the degree of success of this response. In sheep the attempt to surround the parasite with fibrous tissue frequently fails, but this does not seem to be due, as has been suggested, to an inherent inability to produce collagen fibrils of sufficient strength. 154 pages. $2.05. Mic 57-3371

ELECTROPHYSIOLOGICAL AND ELECTROLYTE CHANGES IN FROG STRIATED MUSCLE AFTER IRRADIATION

(Publication No. 22,665)

Edgar B. Darden, Jr., Ph.D.
The University of Tennessee, 1957

Major Professor: Samuel R. Tipton

Electrophysiological and electrolyte concentration changes were studied in the excised frog sartorius following exposure to ionizing radiation. Membrane potentials in individual fibers and changes in muscle potassium were measured at various post-irradiation intervals in paired irradiated and control muscles. Progressive decreases in the membrane potentials were observed beginning in the dose range between approximately 50 and 100 Kiloroentgens, but changes in potassium were not detected

below approximately 150 kr. Above this dose leakage of potassium from the irradiated muscle occurred at a rate increasing with dose and time after irradiation. A study of the distribution of the membrane potential along fibers with declining potentials revealed that the decline was generally not uniform as recorded at various points on the fiber surface. Regions of potential minima appeared to be largely correlated with the locations of subsequently developing visible lesions. In general, these visible necrotic changes took the form of waxy degeneration with the formation of retraction clots and caps of coagulated fiber material as the principal characteristic.

It is suggested that radiation injury in the excised muscle develops along a fairly characteristic pattern with early evidence of injury reflected in a loss of the ionic integrity of the cell surface at small scattered loci more or less randomly distributed with a resulting leakage of potassium at these points. If the damage is sufficiently great, the loss of potassium eventually becomes large enough to be detectable by gross analysis. Subsequently the ability of the fiber to maintain normal structure is lost.

Deteriorative changes in the potential, the electrolyte content, and the physical structure of the fibers were markedly slowed by storage of the exised preparations at a temperature of 2-3° C. 96 pages. $2.00. Mic 57-3372

BIONOMICS OF SYMPHYLA

(Publication No. 22,336)

Clive Arthur Edwards, Ph.D.
The University of Wisconsin, 1957

Supervisor: Assistant Professor Stanley D. Beck

Although the class Symphyla is of considerable phylogenetic interest, and includes important soil pests it is a relatively neglected group of animals.

Biology of Symphyla

The life histories of several species of Scutigerella resembled that of Scutigerella immaculata. Eggs of Symphylella vulgaris, distinguished by spines, hatched into larvae with seven pairs of legs, and after five molts, taking two to three months, the adults appeared. Feeding experiments and dissections of the gut, showed that Scutigerella immaculata was extremely omnivorous, while Symphylella vulgaris fed only on microorganisms and decaying tissue. There were marked feeding and molting cycles with no feeding for approximately one week prior to molting. Observations were made on sensory behaviour.

Ecology of Symphyla

Populations were studied using a standardized sampling technique, consisting of twenty random, vertical 2 1/2" cores and flotation extraction. Of 415 locations sampled, symphylids were present in 32.0% of grassland, 25.8% of forest litter, 44.2% of cultivated soil, and 52.8% of greenhouses. Populations were high, up to 88,000,000 per acre, and the order of decreasing population density was greenhouse soil, outdoor cultivated soil, forest litter, and fallow soil. Studies on optimal soil types showed loams to be most favorable, pure clays and sands least suited, and clay loams and sandy clay loams intermediate. It was concluded that the most favorable soil characteristics for symphylids, were high organic matter content, good moisture holding capacity, and ability of soil to compact and form crevices.

Seasonal migrations of Symphylella vulgaris and Scutigerella immaculate in the soil, outdoors and in a greenhouse, were studied. They migrated to the surface in early spring and to the lower layers during summer, with little rise in surface population during fall. Outdoors, migration to the surface occurred later in spring and the downward migration later in summer, but there was a second peak surface population in fall.

The environemntal factors influencing migrations were studied. Scutigerella immaculata was attracted to plants in laboratory and field experiments, in contrast to Symphylella vulgaris which was not. Soil moisture content exerted a marked effect on symphylid distribution. Gradients of distribution followed gradients of soil moisture, and in laboratory experiments symphylids migrated away from humidities below 80% and could not survive at humidities below 100%. Symphylids died in soils where the soil moisture content fell to levels, corresponding to humidity between the soil particles of less than 100%. Temperature only affected symphylid distribution where it limited survival, and temperature tolerance extended from 0°C to 32°C. Feeding cycles influenced migrations, since 97% of the symphylids around plant roots were in a feeding phase, as compared with approximately two thirds of those in other strata. There was some migration from the surface for egglaying and molting. It was concluded that moisture was the dominant controlling factor in migrations, with minor patterns imposed on this by other factors.

Economic Importance of Symphyla

The economic importance was reviewed and a list of hosts compiled. Symphylids were common soil pests outdoors and in greenhouses in Southern England. A number of species other than Scutigerella immaculata were implicated in serious damage to plant roots. From numerous field and laboratory insecticide trials, three methods of control were developed.

a) Injection with DD at a depth of 9" cleared the soil of symphylids for a period of at least three months, and allowed the plants to get a good start before the symphylids returned to attack the roots.

b) A root watering with parathion solution (1 fl. oz. 20% emulsion in 10 gal. water) gave very good kill, partly by a slight systemic action on the plant root systems. Highest kills resulted when plants were transplanted into infested soil and watered with parathion five days later.

c) Aldrin treatments consisting of 12 lbs. effective material per acre, in many cases gave long term control.

Taxonomy of Symphyla

Keys to genera of Symphyla were devised.

176 pages. $2.30. Mic 57-3373

CHLOROBROMOPROPENE AS A CONTROL OF VERTICILLIUM ALBO-ATRUM R. & B. IN MENTHA PIPERITA L.

(Publication No. 22,256)

Robert Charles Goss, Ph.D.
Purdue University, 1957

Major Professor: C. L. Porter

The purpose of this investigation has been (a) to determine the effectiveness of chlorobromopropene to inhibit the growth of V. albo-atrum and in retarding the expression of the apparent symptoms of the disease by the plant; (b) to investigate the effect of the chemical on the fungus and the bacterial populations of muck soils in northern Indiana; (c) to investigate the residue of the fumigant after two growing seasons; and (d) to analyse chemically the peppermint oil to determine whether it is within the legal standards.

Land was secured on the William Gehring Farms at Newland, Indiana (Jasper County). Approximately one-fifth of an acre was obtained in the Big Field. The area was divided by a random method into eight 20' x 50' individual plots for 1954 and into sixteen randomized 20' x 20' individual plots for 1955.

Four dosage levels were employed in 1954, 0, 40, 80 and 120 gallons per acre. The dosage levels for 1955 varied according to the level of the previous year. The actual dosage in 1955 for the 40 and the 80 gallon plots began at 10 and 20 gallons respectively, and then the dosage was increased 2X until equal to the 1954 dosage. The 120 gallon per acre plots had fumigation levels for 1955 of 40, 80 and 120 gallons per acre.

The results indicated that the chemical had a positive statistical effect on the microorganism population. In 1954 the predominate fungus was Trichoderma viride and in 1955 the predominate fungi were T. viride, Rhizopus nigricans, Aspergillus niger and a Pythium sp. In the plots treated at the highest dosage rates for 1954 and 1955 an actinomycete was isolated which demonstrated inhibition of T. viride, V. albo-atrum, Fusarium sp. and Alternaria humicola.

At the end of the 1954 growing season, August 30, it was estimated that 38.6% of the total area of the 0 treatment was infected and 24.9%, 20.9% and 14.6% for the 40, 80 and 120 gallon treatments respectively.

An indication of a residue, which has a comparable effect on the fungi the second year was noted in the 120 gallon per acre treated plots.

The oil was within the legal standards as set forth in the United States Pharamacopoeia.

115 pages. $2.00. Mic 57-3374

ECTOPARASITES OF THE MEARNS COTTONTAIL IN WISCONSIN

(Publication No. 22,354)

Glenn Edward Haas, Ph.D.
The University of Wisconsin, 1957

Supervisor: Professor Robert J. Dicke

This study was conducted (1) to determine the species and distribution of arthropod ectoparasites which infest cottontails, (2) to describe some of their unknown or poorly known stages, and (3) to extend the knowledge of their biology and ecology.

Approximately 1,200 cottontails were collected from May 1955 to November 1956. The following 17 species of ectoparasites were found.

Bots: Cuterebra buccata (F.)
C horripilum Clark
Fleas: Cediopsylla simplex (Baker)
Ctenocephalides felis felis (Bouché)
Epitedia wenmanni (Rothschild)
Megabothris asio megacolpus (Jordan)
Monopsyllus wagneri systaltus (Jordan)
Nosopsyllus fasciatus (Bosc d'Antic)
Odontopsyllus multispinosus (Baker)
Opisocrostis bruneri (Baker)
Orchopeas howardii howardii (Baker)
O. leucopus (Baker)
Thrassis bacchi bacchi (Rothschild)
Ticks: Dermacentor variabilis (Say)
Haemaphysalis leporis-palustris (Packard)
Ixodes dentatus Marx
Mite: Eutrombicula alfreddugèsi (Oudemans)

The predaceous mite Cheyletiella parasitivorax (Mégnin) was also collected.

State records which appear to be new include the bots, the last tick listed and the mites. Many new county records were established for the fleas and ticks.

The egg, third instar larva, puparium and male genitalia of C. horripilum are described and illustrated. A probable second instar larva which is apparently the same species, and a probable first instar larva of an undetermined Cuterebra species are also described and illustrated. The egg and cocoon of Cediopsylla simplex and the first instar larva which is probably the same species are described. The egg and cocoon are illustrated. In addition, the third instar larva of this flea is redescribed, and illustrated redescriptions of its pupae are presented.

Biological notes on C. horripilum, C. simplex and H. leporis-palustris were recorded through laboratory and insectary rearing. C. horripilum larvae were reared to adults. Larvae hatched from C. simplex eggs but died soon after. Pupae of this species were reared to adults. Eggs oviposited in the laboratory by females of H. leporis-palustris were carried through to larvae and nymphs.

Ecological observations included the seasonal distributions and sex ratios of the ectoparasites on their hosts. Only minor ecological notes were taken on the mites.

No hyperparasites were observed. However, an unidentified fungus apparently parasitized some adults of the rabbit flea, C. simplex. 129 pages. $2.00. Mic 57-3375

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

HOST INDUCED ALTERATION OF EASTERN EQUINE ENCEPHALOMYELITIS VIRUS IN TENEBRIO MOLITOR L.

(Publication No. 22,357)

Charles Fred Hartley, Ph.D.
The University of Wisconsin, 1957

Supervisors: Dr. R. P. Hanson and Dr. R. J. Dicke

Passage of chicken embryo propagated Eastern equine encephalomyelitis virus through the hemocoele of the larvae of Tenebrio molitor L. results in a rapid loss of titer such that infectivity for the chicken embryo cannot be detected within six hours after inoculating the virus into the insect. Using the half-day-old chick, which is a thousand times more susceptible than the embryo, the virus can be recovered up to 17 days after inoculation. The differential rate of alteration was first interpreted as a qualitative change in the virus itself. Although this is still a possibility, it cannot be definitely shown with the data presented. Apparently the difference is more a function of the difference in susceptibility between the embryonated egg and half-day-old chick.

The alteration of infectivity does not occur in pupae or adults of T. molitor, in homogenates or extracts of larvae, or in larvae killed by heat or freezing. It apparently takes place in the hemolymph of the insect and was not reversed by treatment of the altered virus with chick tissues and tissue extracts or with several reducing agents.

The phenomenon conforms to Shop's definition of "masking" but supports Beard's view that masking is a quantitative rather than a qualitative change.

The importance of such hosts to the biology of disease, in that their virus content is not detectable by some of the hosts commonly used in isolating virus from field material, is discussed and their role as reservoir hosts is considered.

62 pages. $2.00. Mic 57-3376

STUDIES ON OXYGEN CONSUMPTION AND AGE-WEIGHT RELATIONSHIP OF LARVAE OF PHAENICIA SERICATA MEIGEN

(Publication No. 22,084)

Herbert Ernest Heist, Ph.D.
State University of Iowa, 1957

Chairman: Professor L. O. Nolf

Studies were made on the sheep blowfly, Phaenicia sericata Meigen, to determine the oxygen consumption during the three larval instars. The larvae were raised and maintained under sterile conditions from the time the eggs were sterilized until the larvae were used in oxygen uptake tests. Determinations were made at intervals varying from ten minutes during the first instar to over four hours during the third instar. The oxygen uptake was the highest at 11,000 ul. per gram per hour during the first hour after hatching. The rate declined rapidly during the first instar, but then decreased more gradually until maintaining a constant rate of approximately 400 ul. per gram per hour during the latter period of the third instar. Determinations were discontinued at 204 hours after hatching when the larvae began pupating.

A study was made of the age and weight relationship of the second instar larvae. These two factors when plotted against each other yield a sigmoid curve. A high positive correlation between metabolic rate and body weight was determined for the second instar larvae.

A method was described for the isolation of sterile collagenase secreted by sterile larvae.

44 pages. $2.00. Mic 57-3377

LIGHT AND ELECTRON MICROSCOPE OBSERVATIONS ON THE PHOTOGENIC ORGANS OF THE FIREFLY, PHOTURIS PENNSYLVANICA DE GEER, WITH SPECIAL REFERENCE TO THE INNERVATION

(Publication No. 22,086)

Byron C. Kluss, Ph.D.
State University of Iowa, 1957

Chairman: Professor H. W. Beams

This study was carried out in the hope of further advancing the knowledge of the fine structural details of the photogenic organ of the firefly and in the hope that by the use of modern neurological techniques the nature of photogenic organ innervation might be demonstrated.

The larval firefly light organ is composed of photogenic and reflector layers, ramifying trachea, and tracheoles, but tracheal end organs are not present. Nerves were observed to branch throughout the photogenic organ; specialized nerve endings, however, were not observed.

The adult photogenic organ is composed of photogenic and reflector layers, tracheal cylinders, tracheal twigs, tracheal end organs, tracheoles, and nerves. The adult firefly nerves were difficult to study with the light microscope but they appear to branch throughout most of the cylinders and to terminate in narrow fibers adjacent to some of the tracheal end cells.

In Photuris pennsylvanica the tracheal end organ is composed of a tracheal end cell which envelops both a tracheal twig and a portion of a tracheolar epithelial cell. The tracheolar epithelial cell nucleus is surrounded by a thin layer of cytoplasm that continues as a narrow band and attaches to the tracheal twig just before it branches into tracheoles. This tracheolar epithelium follows the tracheoles to their termination. Immediately below the point of origin of the tracheoles the epithelium widens to form an end bulb which contains numerous small mitochondria.

The membrane of the tracheal end cell adjacent to the central region of the tracheal twig is deeply folded and within each fold a single large filamentous mitochondrion is located.

The photogenic cell nuclei of larval and adult fireflies contain masses of chromatin material, while the larval nuclear membrane bears annuli of 700 to 900 A in outside diameter. The photogenic cell cytoplasm contains lamellar photogenic granules, mitochondria, clear vacuoles, and partially-filled vacuoles called round bodies.

The free surfaces of the photogenic cells in the adult

have a narrow border, free of photogenic granules and packed with mitochondria, referred to as the differentiated zone.

The axoplasm of nerve contains numerous smooth neurofilaments of indefinite length that vary in width from 100 to 170 A. An occasional mitochondrion is also found in the axoplasm of the nerve.

The axon is wrapped by approximately six layers of a membrane that may be derived from the surrounding neurilemmal cells. These layers are presumably myelinated lamellae, comparable to the myelin of vertebrate nerves.

A layer of connective tissue surrounding the neurilemma was not observed in the peripheral nerves of the firefly.

In this study all trachea, tracheal twigs, and tracheoles observed have taenidia and are covered with tracheal epithelial cells. The area immediately around the tracheoles in the larva and in the adult is honeycombed in appearance.

64 pages. $2.00. Mic 57-3378

A STUDY OF PRENATAL AND POSTNATAL DEVELOPMENT IN THE OLDFIELD MOUSE, Peromyscus polionotus

(Publication No. 22,230)

Samuel Kanada Laffoday, Ph.D.
The University of Florida, 1957

Development of the oldfield mouse, Peromyscus polionotus, was described from the time of insemination to the time when the animals approached adult limits. Recently-ovulated eggs were surrounded by a corona radiata which was largely gone by fifteen hours. The zona pellucida was present through the eight cell stage.

At twenty-four hours, embryos were in the two cell stage, at forty-eight and sixty hours in the four cell stage, and by seventy-two hours in the eight cell stage. By ninety-six hours, they were generally in the blastocyst stage; implantation occurred on the fifth day and by eight days the amniotic, exocoelom and ectoplacental cavities were present; at nine days the allantois had started to form; and by ten days the body form had become U-shaped, the allantoic stalk had joined the chorion and the first aortic arch was present. Blood which was present in the extra-embryonic and amniotic cavities of embryos at nine days appeared to be of maternal origin. On the twelfth day, the body was in the form of a tightly coiled C; limb buds were present, and the third aortic arch had formed. By the fifteenth day, vibrissae follicles occurred on each side of the snout, and the mammalian nature of the embryo could be recognized. By eighteen days, the fetus had about the same appearance as at birth. The pinna of the ear had folded over the opening, eyelids had formed and the eyes were half closed, the tongue had withdrawn from the lips, the mouth was almost closed, and the digits were fully formed.

Slight to considerable variation in development of embryos of the same gestation period was noted.

Parturition was observed and is described in detail. In nonlactating females the gestation period was twenty-three to twenty-four days, but in lactating females it was twenty-five to thirty days. Post partum heat occurred within twenty-four hours after parturition and the average duration of the estrous cycle was about five days. The average size of fifty-two litters was 3.35, while the average number of embryos in twenty-seven pregnant females was 3.55. The sex ratio of the litters was 50.78 per cent males and 49.22 per cent females. Weight at birth varied from 1.1 to 2.1 grams, with a mean of 1.61 grams. At birth the eyes were closed, the ear pinna were folded down over the external auditory meatus, and the overall body color was pink with the dorsum being slightly darker. Postnatal growth was rapid for the first thirty days after birth, but then slowed down considerably and virtually ceased after fifty days. The ear pinna unfolded on the third or fourth day and incisor teeth erupted the gum from the sixth to eighth day. Young mice reacted to sound at around eleven days of age. The eyes opened between thirteen and fifteen days, usually on the fourteenth day. The vagina of females opened between twenty-nine and thirty-five days, and the post juvenile molt started at thirty-four to thirty-six days of age.

In general both prenatal and postnatal development of P. polionotus resembled the development of Mus, Rattus, and Mesocricetus, whose development has been adequately described. In the time of appearance and the shape and structure of the ectoplacental cone, Peromyscus resembles Mus and Rattus rather than Mesocricetus, to which it is generally considered to be more closely allied. Possibly the nature of the ectoplacental cone is of taxonomic significance in the murid and cricetid rodents.

133 pages. $2.00. Mic 57-3379

SOME ECOLOGICAL RELATIONS IN THE MAMMOTH HOT SPRING TERRACES, YELLOWSTONE NATIONAL PARK

(Publication No. 22,135)

Joseph Robison Murphy, Ph.D.
The University of Nebraska, 1957

Adviser: Irving H. Blake

The Mammoth Hot Spring Terraces, outstanding for their scenic beauty and geological interest, were analyzed bioecologically in an attempt to discern the major components of the biota, the physical factors provided by the terrace environment, and the adjustment of the biota to both physical and biological surroundings.

Comprising an area of approximately three square miles, the terraces lie between altitudinal levels of 5,700 to 7,200 feet. The climate is transitional between that of the northern prairie regions and the montane coniferous forest, and fosters the development of a shrub-grass climax below the elevation of 6,100 feet and a climax Douglas fir forest above that altitude. These climax communities closely resemble similar stands of vegetation on adjoining non-terrace areas. However, there is a marked distinction in the type of sere leading to the climax forest on hot spring deposits as contrasted with adjacent areas. It would appear, therefore, that the edaphic conditions provided by the hot spring deposits (travertine) are responsible for the unity of the terrace ecosystem.

Two distinct sets of environmental conditions are operative in the study area, namely the environment of the

thermal springs proper, and that of the terrace deposits following cessation of hot spring activity. Each environment has its distinct biota. A definite pattern of succession obtains on dormant travertine, involving three main seral stages: pioneer or early seral stages, limber pine-juniper subclimax forest, and climax Douglas fir forest.

The hydrothermal environment is conditioned by a complex set of physico-chemical factors. Among these are: warm water temperatures, high salinity combined with a wide range of pH, and a deficiency of dissolved oxygen and nitrogen. The only organisms found in strictly thermal waters (above 50° C) are blue-green algae and certain bacteria. The variety of species of Myxophyceae growing in the waters at Mammoth provide these springs with an important thermal flora. The invertebrate fauna is composed primarily of insects, the most important species being ephydrid flies, stratiomyid larvae, and hydrophilid beetles. Although vertebrates are absent from the thermal waters proper, the areas immediately bordering the runoff channels are used for nesting by two species of birds.

Following the termination of hydrothermal activity in a given locale, the barren terraces begin to undergo a succession of physical and biotic changes. Early seral stages are characterized by the invasion of pioneer plants such as stonecrop and shrubby cinquefoil. The typical invertebrates are certain spiders, ants, and ant lions. The most conspicuous vertegrates are the yellow pine chipmunk and mountain bluebird.

The subclimax forest is composed of limber pine and juniper, with a generally scanty herbaceous understory. The principal invertebrates of the ground layer are ants, with cicadellids and certain hemipterans characterizing the tree layer society. Gradual replacement of the subclimax trees by Douglas fir produces the climax forest. Mature stands are composed almost exclusively of Douglas fir, with a distinctive shrubby understory. Lepidopterous larvae, parasitic Hymenoptera, and coccinellid beetles are the most important invertebrates.

The permeant influents of both subclimax and climax forests include several species of forest-nesting birds and the usual montane coniferous forest mammals. Outstanding are the Clark nutcracker, mountain chickadee, wapiti, mule deer, red squirrel, yellow pine chipmunk, white-footed mouse, black bear, coyote, and Yellowstone bat.

Rejuvenated hot spring activity may occur at any stage during the sere, including the climax. This unpredictable phenomenon is a potent environmental factor, in that it may markedly alter or indefinitely postpone the biotic sequence of development. 198 pages. $2.60. Mic 57-3380

STUDIES OF THE BIOLOGIES OF THREE RELATED LEGUME APHIDS WITH SPECIAL REFERENCE TO HOST PLANTS

(Publication No. 21,759)

Don Clayton Peters, Ph.D.
Kansas State College, 1957

The purposes of these experiments were to determine the host plant relationships of the spotted alfalfa aphid (Pterocallidium sp.), the yellow clover aphid (Pterocallidium trifolii (Monell)), and the sweetclover aphid (Myzocallidium riehmi Börner). Biological relationships between the hosts and each of the aphids were studied.

The available literature was reviewed, particularity with reference to host plant relationships.

The materials and methods used in this study were those that would yield results applicable to a gross determination of differences in insect-host relationships. Some field observations were made, but the bulk of the data was collected in the greenhouse where temperature and moisture could be controlled in order to meet the varied environmental conditions required by the different plant species.

The methods used involved infesting plants with a known number of aphids. Subsequent notes on aphid survival, damage to plants, reproduction, and weight of adults were recorded. Average temperatures during most of the studies usually ranged from 70° to 80° F. Over 70 small seeded legumes were studied.

The sweetclover aphid found its hosts in only two genera, Melilotus and Trigonella; the other two species have differing host relationships through-out Medicago, Melilotus, Trifolium, and Trigonella. Twelve species in these genera were immune to resistant to all three aphids. All species of Medicago were susceptible to the spotted alfalfa aphid. The same was true of the yellow clover aphid and the Trifolium plant species studied and also the sweetclover aphid on the different species of Melilotus. Of all species studied eighteen were susceptible to the sweetclover aphid while about twice this number were susceptible to both of the other aphid species. Plants of other genera studied were generally immune to all three aphid species, but some plants of Dalea alopecuroides were susceptible to the yellow clover aphid. The spotted alfalfa aphid and the yellow clover aphid were able to feed on some plants of Lespedeza stipulacea, but they could not maintain a population. Six legume species of Melilotus and Trigonella serve as hosts about equally well for all three aphid species.

Alfalfa was not attacked by the yellow clover aphid or the sweetclover aphid; and most plants of sweetclover were not injured by the yellow clover or the spotted alfalfa aphid. Red clover was not infested by the sweetclover or the spotted alfalfa aphid. Within most plant species studied individual plants differing in reaction to one or more of the aphid species were evident. Twenty-two of the 38 hosts of the spotted alfalfa aphid were variable in their aphid reactions.

In the biological studies adult survival, fecundity, adult weight, and nymphal survival were observed. The data from each factor in relation to the host species studied appeared to form an intergrading series. Observations would seem to indicate complex genetic factors may be

involved in the biological effects observed on the plant species studied.

Host plants of the respective aphid species reported for the first time in these studies were:

for the spotted alfalfa aphid;

Medicago
- arabica
- arborea
- blancheana
- ciliaris
- orbicularis
- praecox
- rigidula
- ruthenica
- scutellata
- truncaiata
- tuberculata

Melilotus
- dentata
- hirsuta
- italica
- messanensis
- segetalis
- taurica

Trifolium
- agrarium
- dubium
- procumbens
- xerocaphulum

Trigonella
- balansae
- coerulea
- foenum-graecium
- kotchy

for the yellow clover aphid;

Dalea
- alopecuroides

Medicago
- arborea
- ciliaris
- praecox

Melilotus
- dentata
- indica
- italica
- messanensis
- segetalis

Trifolium
- arvense
- campestre
- dubium
- fragiferum
- glomeratum
- hirtum
- incarnatum
- lappaceum
- medium
- nigrescens
- procumbens
- radiosum
- resupinatum
- subterraneum
- xerocaphulum

Trigonella
- balansae
- coerulea
- kotchy

for the sweetclover aphid;

Melilotus
- dentata
- hirsuta
- indica
- italica
- leucantha
- messanensis
- ruthenica
- segetalis
- suaveolens
- taurica

Trigonella
- balansae
- coerulea
- foenum-graecium
- kotchy.

102 pages. $2.00. Mic 57-3381

A STUDY OF THE RELATIONSHIP BETWEEN THE INORGANIC CONTENT OF THE BLOOD OF CRAYFISH AND THEIR ENVIRONMENT

(Publication No. 21,307)

Alta Virginia Presson, Ph.D.
Purdue University, 1957

Major Professor: Clarence J. Goodnight

Determinations were made for four inorganic ions in the blood of crayfish after the animals had been exposed 48 hours to experimental external solutions. The experimental solutions contained three levels of the inorganic ions - potassium, calcium, sodium, and magnesium. Values for four species of crayfish, Procambarus clarki, Procambarus blandingi, Orconectes virilis, and Orconectes immunis, at three temperatures, room temperature, 10°C. and 20°C. were determined.

Calcium values ranged from 39.7 to 80.0 mg. per 100 ml. of blood. A species difference in blood calcium was observed in two cases. A statistical difference was noted between solutions in two cases, but temperature seemed to have no effect on the blood calcium.

Potassium values for the controls fall within the range as observed in the literature. The range for this study was 18.75 to 38.75 mg. per 100 ml. serum. Significant difference between species in one case was observed in the hypotonic solution. No effect of temperature on the potassium blood level was observed. The concentration of the external solution significantly affected the blood level in two cases - one for Procambarus clarki, at room temperature and one for Procambarus blandingi, at 10°C.

Sodium values ranged from 320.0 to 650.0 mg. per 100 ml. blood. A significant difference between species was noted in solution II at 10°C. The external solution concentration had some effect on the blood serum for Orconectes immunis, at room temperature and for Procambarus blandingi, at 10°C. Sodium is the only ion that was affected significantly by temperature. The sodium concentrations of the hypotonic solution for Orconectes virilis and Procambarus blandingi were significantly different at the various temperature levels.

Magnesium values ranged from 0.5 to > 10 mg. per 100 ml. blood. No significant differences were noted between the values at the various temperatures nor in the various solutions. No analyses were made between species for magnesium concentration.

No Correlations between ions were noted.

Mortality rates on the average, were lowest for the isotonic solution. Mortality rates were lowest in this solution for Procambarus clarki, and Orconectes immunis, and for the hypotonic solution for Procambarus blandingi, and Orconectes virilis.

Carapace lengths ranged from 2.97 to 6.30 cm. The ability of the animal to adjust to the experimental solution seemed to decrease as the carapace length increased.

82 pages. $2.00. Mic 57-3382

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THE STRUCTURAL SIGNIFICANCE OF THE AVIAN YOLK IN EMBRYOGENESIS

(Publication No. 22,475)

Allen Brian Schlesinger, Ph.D.
University of Minnesota, 1957

Measurements of the latebral system of frozen egg yolks show that the general polarity of the yolk is reflected in the structure of the latebra and the latebral neck. The lamellar nature of the yolk is similarly seen in the fine structure of the latebra which is composed of layers of relatively clear fluid alternating with layers consisting of white yolk spheres. The frozen latebra does not show the irreversible viscosity increase which is typical of frozen yellow yolk.

Dye injected into the yellow yolk fails to move appreciably during periods of time up to three days whereas dye injected into the white yolk latebra shows great mobility beginning immediately after injection. This difference in the behavior of the dye is essentially due to the difference in viscosity of the two types of yolk. The white yolk in the latebral system is much more fluid. When dyes of a density lower than that of the white yolk are injected into the latebra they rise in the latebral neck so as to underlie the blastoderm. Although the latebral system is a distinct structure, there is no evidence for the presence of a membrane separating it from the yellow yolk. There is similarly no evidence for the presence of a transport system. The possible role of the latebra as a reserve supply of white yolk is presented.

The mobility of the latebral system increases with incubation time apparently as the result of viscosity decrease. This decrease in viscosity is a general effect of ageing. The original structure of the yolk degenerates with time as the lighter elements rise to the animal pole. The same stratification of light and heavy components occurs very rapidly following mechanical disruption of yolk structure. The original distribution of yolk components is unstable and is maintained by the relatively high viscosity of the system.

The peripheral white yolk was studied using the same freezing technique as was used for the latebral studies. The peripheral white yolk does not show the sharp demarcation from the yellow yolk which is characteristic of the latebra. The peripheral yolk is more viscous than latebral yolk but less viscous than the yellow yolk. Thawing of frozen peripheral yolk produces only a partial restoration of the original fluidity.

Production of defects in the continuity of the peripheral yolk results in an interference with blastodermal spread. Yellow yolk does not possess the same growth supporting capacities as does white yolk. In bypassing the defects, the blastoderm demonstrates the ability to spread both at right angles to, and the reverse of, its normal pattern.

Isolated portions of the marginal blastoderm spread over the yolk in the same manner and at the same rate as do intact blastoderms. The results of such isolation studies indicate that blastodermal advance is accomplished by active marginal outgrowth.

The rate of blastodermal advance decreases sharply following 72 hours of incubation. Yolk sac closure is approximately 80% complete at this time. The possible role of the peripheral yolk in limiting the growth rate is presented.

42 pages. $2.00. Mic 57-3383

BIONOMICS AND CONTROLS FOR CERTAIN SCALE INSECTS (COCCOIDEA, HOMOPTERA)

(Publication No. 22,296)

Donald Lloyd Schuder, Ph.D.
Purdue University, 1957

Major Professor: Howard O. Deay

This thesis was designed to procure information on the taxonomy, bionomics and control of four species of scale insects: Lepidosaphes ulmi (L.), L. yanagicola Kuwana, Aonidomytilis solidaginis (Hoke) and Trachycoccus hyperici Ferris.

All of the species studied are phytophagous. Suitable host plants for each were obtained and planted in the experimental nursery on the Agronomy Farm near West Lafayette, Indiana. Common lilac, Syringa vulgaris, and red twig dogwood, Cornus stolonifera, plants were potted for use in the greenhouse and insectary while studying L. ulmi. When desired infestations of these scale insects were not present, the plants were artifically infested. Life history observations, control experiments and host relationships were studied in the field. Taxonomic relationships, morphological characteristics, mortality counts, geotactic and phototactic reactions were studied in the laboratory.

These studies and observations revealed that there are two distinct races of the oystershell scale, Lepidosaphes ulmi, in the vicinity of Lafayette, Indiana. The two races are called the gray race and the brown race. The brown race common on apples, Persian lilac and red twig dogwood differs markedly from the gray race which is most frequently found on common lilac. The brown race has two generations per year while the gray race has only one. Both males and females are present in the brown race but only females have been found in the gray race. As the names imply the color of the scales of the two races are different. The brown race has a uniform mahogany brown scale while the gray race are brown transversed by distinct stripes of gray. Weathered scales of the brown race are a uniform darker brown while those of the gray race are gray all over, but the stripes are still discernible. The brown race females average 3.14 mm. in length while the gray race averages 2.74 mm. in length. Both scales resemble a miniature oyster shell, hence their common name. The male of the brown race has a scale smaller than the mature female. The male scales average 1.02 mm. in length and have nearly parallel sides. Both races of L. ulmi overwinter in the egg stage. Because of the above differences and the fact that the females differ in the structure of the antennae, shape, size and number of glands the writer concludes that the brown and gray races of the oystershell scale are separate species.

Aphelinus mytilaspidis LeB. is an important predator of both races of the oystershell scale.

The oystershell scale may be controlled by applying parathion, demeton, Thimet or malathion to the newly hatched crawlers. Dormant sprays and summer dusts were less effective than the crawler sprays.

Lepidosaphes yanagicola Kuwana commonly attacks winged euonymus, Euonymus alatus, and dwarf winged euonymus, E. alatus compactus, in Ohio and Indiana. The scale is found on the bark between the corky ridges. It is

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also capable of infesting pachysandra, Pachysandra terminalis, strawberry bush, Calycanthus floridus, little leaf winter creeper, E. fortunei minima, bittersweet, Celastrus scandens, purple leaf winter-creeper, E. f. atropupureus, purple leaf plum, Prunus americana "Newport", dwarf arctic hedging willow, Salix purpurea nana, Salix sp., and chaste tree, Vitex agnus-castus. The female scale, which is about 0.74 mm. in length, resembles a miniature oyster shell and is difficult to detect since the color of the scale closely resembles that of the bark. No males of this species were found in Indiana.

The insect overwinters either as an adult female or as an immature second-stage female nymph. The former begins to produce eggs in early June and the latter the last of July. There is one generation annually. However, since the eggs are produced at different times during the growing season the subsequent stages may be found at almost anytime of the year.

L. yanagicola may be controlled by applying parathion, malathion or DDT to the newly hatched crawlers in the summer. During the winter months lime sulfur or DN-289 may be used.

The mite, Hemisarcoptes malus Shimer, was found attaching L. yanagicola and A. solidaginis and may be an important factor in the natural control of these insects.

Aonidomytilis solidaginis attacks the shrub St. John's Wort, Hypericum prolificum, in the vincinity of Lafayette, Indiana. The insect is found under the edges of the peeling bark. The female is a yellowish-white to tan, about 2mm. long and resembles in shape a miniature oyster shell. The male scale is smaller, about 1.3 mm. long, with nearly parallel sides and is a yellowish-white in color.

A. solidaginis overwinters as a fertilized adult female which begins producing eggs the last of April. There are three generations annually, but they overlap so that the insect may be found in almost any stage at anytime during the growing season. The insect may be controlled by applying parathion or malathion to the newly hatched crawlers. Dormant sprays were not effective against this species. The mite Hemisarcoptes malus Shimer is an important parasite.

Trachycoccus hyperici also attacks St. John's Wort in the vicinity of Lafayette, Indiana, where it is found on the twigs and branches of the host under the edges of the peeling bark. The female is a dark reddish-purple, covered with white cottony fibers so that it superficially resembles a mealybug. The female insect is about 1.18 mm. long. The male is smaller, about 0.62 mm. The male may be winged or wingless when it emerges from its small white cocoon. The wings of the winged males are about one and a half times as long as the body.

T. hyperici overwinters as a fertilized female which begins to produce crawlers in mid-May. There are two generations annually, with crawlers of the second generation present in early August. Crawlers are produced, however, almost continuously throughout the summer so that the insect may be found in about any stage at anytime during the summer.

The twice-stabbed ladybird beetle, Chilocorus stigma (Say), feeds on T. hyperici in all stages. The thrip, Karnyethrips harti Hood, was found among colonies of this scale on several occasions and may be a predator.

T. hyperici may be controlled by applying Phosdrin, Compound 12008, parathion or malathion when crawlers are being produced. Dormant sprays were not effective against this species of scale insect.

179 pages. $2.35. Mic 57-3384

THE ROLE OF SYSTEMIC INSECTICIDES IN THE CONTROL OF INSECT PESTS OF WOODY ORNAMENTAL PLANTS

(Publication No. 22,216)

Robert Eugene Treece, Ph.D.
Cornell University, 1957

Studies were conducted to determine the possible role of systemic insecticides in the control of insect and mite pests of woody ornamental plants. The systemics investigated were Phosdrin, Thimet, demeton, American Cyanamid 12008 and 12009, Shell OS1808 and OS2046, Isolan, Pyrazoxon, Meta-systox, Meta-Isosystox, Chemagro CC131 and CC141, and a series of Bayer compounds. Results of translocation experiments were assayed by observing kill of indicator insects or mites.

Higher dosages applied to soil were required to obtain mortality of mites on broad leaved evergreens than have been reported to be effective on more succulent plants. Dosages of 1 pound technical systemic per 1000 square feet of soil surface gave only fair control in 24 hours, and good control by three days after treatment. A wind tunnel was utilized to eliminate toxic vapors.

The 24 hour LD50 of American Cyanamid 12008 as a soil treatment to Ilex crenata Thunb. var. convexa Makino was 0.633 ± 0.164 pound actual American Cyanamid 12008 per 1000 square feet.

Some downward translocation was observed as a result of paint brush applications of systemics to stems and leaves in the field. Upward translocation was, however, more extensive than downward translocation. Isolan was translocated downward more extensively than any other systemic tested.

Thimet was ineffectively absorbed and translocated from most stem and leaf applications to birch, Malus, Prunus, black walnut, spirea, and Tilia cordata. In contrast, Phosdrin, American Cyanamid 12008, and Isolan were translocated some distance from treated areas, as evidenced by kill of indicator insects. There was more translocation from treatments applied to stems than when applied to leaves 12 to 15 inches from the terminal. The indicator insects used were birch leaf miner, apple aphid, Hyalopterus sp., Hysteroneura setaria (Thos.), Phylloxera sp., spirea aphid, and Therioaphis tiliae (L)., respectively. Pine bark aphid was not controlled by trunk applications.

The inability to control free feeding lepidopterous larvae by translocated systemics was borne out by the failure of trunk and stem applications of systemics to control the eastern tent caterpillar.

Granulated formulations of Thimet and Bayer 19639 were applied to Japanese black pine for control of the Nantucket pine moth. Results with Bayer 19639 were erratic. However, 10 pounds Thimet per acre gave moderate control.

Replicated dilute foliage sprays were applied to many plants with a hydraulic sprayer. Phosdrin, although

supposedly having rapid but short residual activity, was nearly as effective as other systemics against the birch leaf miner. It displayed a very effective immediate action against eastern tent caterpillar, juniper webworm, and bagworm. Thimet and American Cyanamid 12008 were not as effective as Phosdrin in control of free feeding lepidoptera. Only in the control of the eastern tent caterpillar were they completely effective. In the control of the Nantucket pine moth, both Thimet and American Cyanamid 12008 were nearly equal to DDT.

Foliage applications of systemics gave control of scale insects, including European elm scale, juniper scale, Pulvinaria floccifera (Westw.), Aspidiotus pseudospinosus Woglum, and Pseudococus sp. However, most materials tested were rather ineffective against Matsucoccus resinosae G. & B. Demeton gave the highest rate of control.

Foliage applications of systemics resulted in good control of the southern red mite. However, no information was obtained on residual activity more than two weeks after treatment. 170 pages. $2.25. Mic 57-3385

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